Hungarian Earthquake Bulletin
1999

Geophysical Research and Consulting Ltd

HUNGARIAN EARTHQUAKE BULLETIN

1999

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Bibliographic reference

Tóth, L., P. Mónus and T. Zsíros, 2000.
Hungarian Earthquake Bulletin, 1999.
GeoRisk, Budapest, pp. 71.

BUDAPEST 2000

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This work was supported by *Paks Nuclear Power Plant Ltd.* and *Public Agency for Radioactive Waste Management.*

ISSN: 1219-963X

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Back cover page: Distribution of earthquake epicenters in the Pannonian region and its surroundings (44.0-50.0N; 13.0-28.0E). The earthquake database of the region contains 12,713 historical and instrumentally recorded events from 456 AD until 1998. Events excluded from the map if epicenter accuracy is less than 50 km. Size of circles are proportional to the calculated magnitudes.

CONTENTS

ACKNOWLEDGEMENTS

The earthquake monitoring project is sponsored by *Paks Nuclear Power Plant Ltd. (PA RT)* under *GeoRisk*'s contract No. 9257000001 and by *Public Agency for Radioactive Waste Management (PURAM)* under *GGKI* 's contract No. P200V-4-03/99.

Organizations supplying data for this Bulletin are:

Geodetic and Geophysical Research Institute (GGKI)
GeoRisk Geophysical Research and Consulting Ltd.
Hungarian Oil Company Ltd. (MOL Rt.)
Paks Nuclear Power Plant Ltd. (PA Rt.)
Public Agency for Radioactive Waste Management (PURAM)

Data interchange with a number of seismic stations from the neighboring countries contributed to the accuracy of event locations. Those are *Austria, Croatia, Czech Republic, Germany, Romania, Slovakia and Slovenia.*

INTRODUCTION

The Pannonian region occupy the territory between the Mediterranean area, what seismically is one of the most active regions in the world, and the East European Platform what can be treated as nearly aseismic. The Pannonian basin is bounded on the north to the east by the Carpathian mountain belt, on the south by the Dinarides mountain belt and on the west by the Eastern Alps. The area is tectonically rather complex and has been studied intensively for the last twenty years. Development of the Carpathian mountain belt and the Pannonian basin is attributed to collision between the Eurasian Plate and the African Plate between the Paleocene and Middle-Late Miocene. Different authors basically agree that the present-day deformation in the Pannonian basin system is controlled by the northward movement and counterclockwise rotation of the Adriatic micro plate relative to Europe.

The study of the current tectonics requires input data from the seismic activity of the area: if existing tectonic features are active in the present, or were active in the near past, this necessarily should be reflected in current seismicity. By definition, areas where earthquakes occur are areas of active tectonics. Earthquakes represent the sudden release of slowly accumulated strain energy and hence provide direct evidence of active tectonic processes. However, low and moderate seismicity at intraplate areas generally precludes reliable statistical correlation between epicenters and geological features.

Seismicity in the Pannonian basin is relatively low comparing to the peripherals and the distribution of earthquake epicenters shows a rather scattered pattern at the first glance. It is particularly difficult to decide whether the epicenters occur at isolated places or along elongated zones however, at several single places earthquakes occur repeatedly. For example, near to Eger (47.9N; 20.4E) at least sixteen earthquakes with more than fifty greater aftershocks occurred over a time interval of some 70 years. Komárom and Mór area (47.4-47.8N; 18.2E), Jászberény (47.5N; 20.0E), Kecskemét (46.9N; 19.7E) and Dunaharaszti (47.4; 19.0E) also produced significant activity over a certain but limited period of time. Moderate seismicity does not necessarily mean moderate size of earthquakes: reports of major earthquakes often refer to heavy building damage, liquefaction (e.g. 1763 Komárom earthquake, M 6.2; 1911 Kecskemét earthquake, M 5.6) and sometimes the

possibility of fault rupture (e.g. 1834 Érmellék earthquake, M 6.2). These observations indicate that magnitude 6.0-6.5 earthquakes are possible but not frequent in the Pannonian basin. Several authors have shown the difficulty in constructing any meaningful geographical pattern of epicentral distribution when the statistical significance of the data is so low. Using only historical and early instrumental data, it really has been very problematic to find strong correlation between known tectonic structures and earthquakes. The recent high quality earthquake observations and locations may gradually change this situation.

The *Paks Micro-seismic Monitoring Network* has been operational since 1995. In 1999, a new set of stations (*Üveghuta Micro-seismic Monitoring Network*) has been installed with primary purpose of monitoring a potential nuclear waste disposal site. The typical detection threshold of the current local networks, supported by other existing stations, is around 1.5-2.0 ML, somewhat lower in the middle of the country and a little higher towards the border regions. This means that in most part of the country it is very unlikely that felt earthquakes go undetected.

In 1999, some 400 seismic events have been recorded by the monitoring networks and 81 of them happened in the monitored geographic window given below. The developing database of these well-located earthquakes can be used, in one hand, to resolve the tectonic framework in the Pannonian Basin and required on the other hand to refine our understanding of the level of seismic risk in Hungary.

Further to the better understanding of the seismic hazard, the seismic monitoring project has been successful in accumulating seismic data to accuracy not before possible, giving a significant contribution to improve the understanding of the earthquake mechanisms within the whole Pannonian Basin.

This Earthquake Bulletin is a united annual summary report of all earthquake-monitoring projects. The information in the Bulletin is based on all available earthquake related data provided by different organizations. The geographic region covered is bounded by latitudes 45.5-49.0N and longitudes 16.0-23.0E.

1.

SUMMARY OF 1999 SEISMICITY

1999 was a quiet year for Hungarian seismicity. There were 81 seismic events ($0.5 \leq ML \leq 3.8$) located within the area bounded by latitudes 45.5-49.0N and longitudes 16.0-23.0E. Four earthquakes were reported as felt. None of the earthquakes caused significant damage. The highest magnitudes (ML) assigned to a shock was 3.8 at Nagyhódos, NE of Hungary.

The highest intensity reported during the year was 5 EMS, slight earthquake damage was reported.

Reviewing the more notable earthquakes of the year in chronological order, a shock of magnitude 3.8 ML on the 4th of January at Nagyhódos produced reports of intensity 4-5 EMS. On June 4th, an earthquake near Siklós with a magnitude of 3.0 ML was felt at the southern part of Hungary with a maximum intensity of 4 EMS. On August 3rd an earthquake (2.8 ML) at Taktabáj gave rise to reports of intensity 5 EMS. The Békés earthquake of 3rd September (3.4 ML) had intensity 3 EMS at the epicenter area.

2.

SEISMOGRAPH STATIONS IN HUNGARY

In 1999, there have been slight improvements with the Hungarian earthquake monitoring network compared to the previous year. Two station sites have been closed up and three new seismograph stations installed. A new strong motion recorder has been set up near to Budapest.

The micro-seismic monitoring network established by the *Paks Nuclear Power Plant Ltd.* in 1995, has been operational throughout the year. In 1999, the network has been slightly reconfigured and extended (*Üveghuta network*) to monitor micro-seismic activity at a potential nuclear waste disposal site vicinity.

In addition to the information from the eleven station *Paks* and *Üveghuta* micro-seismic monitoring network, data is contributed by four stations operated by the *Seismological Observatory, GGKI.* Of those, one belongs to the *Ministry of Foreign Affairs* and is operated in cooperation with the German GEOFON network.

Data interchange with stations from the neighboring countries and international data centers was also important.

The estimated detection capabilities of the present network with average noise conditions, supposing that at least four stations is needed for origin determination, is typically around 1.5-2.0 ML, somewhat lower in the middle of the country and a little higher towards the border regions. (See Fig. 2.4) This means that in most parts of the country it is very unlikely that felt events go undetected.

During the reporting period, we also had access to six strong motion accelerograph stations belonging to and operated by different organizations such as *Paks Nuclear Power Plant, GeoRisk, GGKI, Ministry of Environment* and *MOL RT.*

Seismograph Stations

Table 2.1. *Seismic stations, instrumentation and lithology*

Code	Latitude (N)	Longitude (E)	Elevation (m)	Foundation	Type of station (1)	Sensor type (2)	Recording (3)	Org. (4)
BUD	47.4836	19.0239	196	dolomite	3C LP	Kirnos	A - C	GGKI
BUDA	47.4836	19.0239	196	dolomite	3C SP	LE-3D	D - E	GR
GYL	46.5981	21.1718	92	sand	3C SP	SS-1	D - E	GGKI
PENC	47.7905	19.2817	250	alluvium	3C SP	LE-3D	D - E	GGKI
PKS0*	46.5743	18.8449	100	sand	3C SP	LE-3D	D - E	GR
PKS2	46.4920	19.2131	106	sand	3C SP	LE-3D	D - E	GR
PKS4*	46.2340	18.4635	220	limestone	3C SP	LE-3D	D - E	GR
PKS6	46.5998	19.5645	120	sand	3C SP	LE-3D	D - E	GR
PKS7	47.0473	19.1609	95	mud	3C SP	LE-3D	D - E	GR
PKS8	46.8787	18.6765	135	rhyolite tuff	3C SP	LE-3D	D - E	GR
PKS9	46.5870	18.2789	240	loess	3C SP	LE-3D	D - E	GR
PKSc	47.3806	18.4371	200	dolomite	3C SP	LE-3D	D - E	GR
PKSm	46.2119	18.6413	170	granite	3C SP	LE-3D	D - E	GR
PKSn	46.8972	19.8673	110	sand	3C SP	LE-3D	D - E	GR
PSZ	47.9184	19.8944	940	andesite	3C BB	STS-2	D - C	GGKI
RHK1*	46.0984	18.0735	300	limestone	3C SP	LE-3D	D - E	GGKI-GR
RHK2*	46.1310	18.7883	100	loess	3C SP	LE-3D	D - E	GGKI-GR
RHK3*	45.8915	18.2538	400	limestone	3C SP	LE-3D	D - E	GGKI-GR
SOP	47.6833	16.5583	260	gneiss	3C SP	SS-1	D - E	GGKI

(1) 1C - one component vertical seismometer, 3C - three component seismometer
SP - short period seismometer, BB - broad band seismometer, SM - strong motion accelerograph

(2) STS-2 - Streckeisen broad band seismometer, LE-3D - Lennartz three directional 1Hz geophone,
SS-1 - Kinemetrics 1Hz seismometer, Kirnos - 12 s long period seismometer

(3) A - analogue, D - digital, C - continuous recording, E - event recording

(4) GGKI - Geodetic and Geophysical Research Institute, GR - GeoRisk Ltd., PART - Paks Nuclear Power Plant Ltd.

(*) PKS0 and PKS4 off date 1999/11/07 RHK1, RHK2 and RHK3 on date 1999/11/18

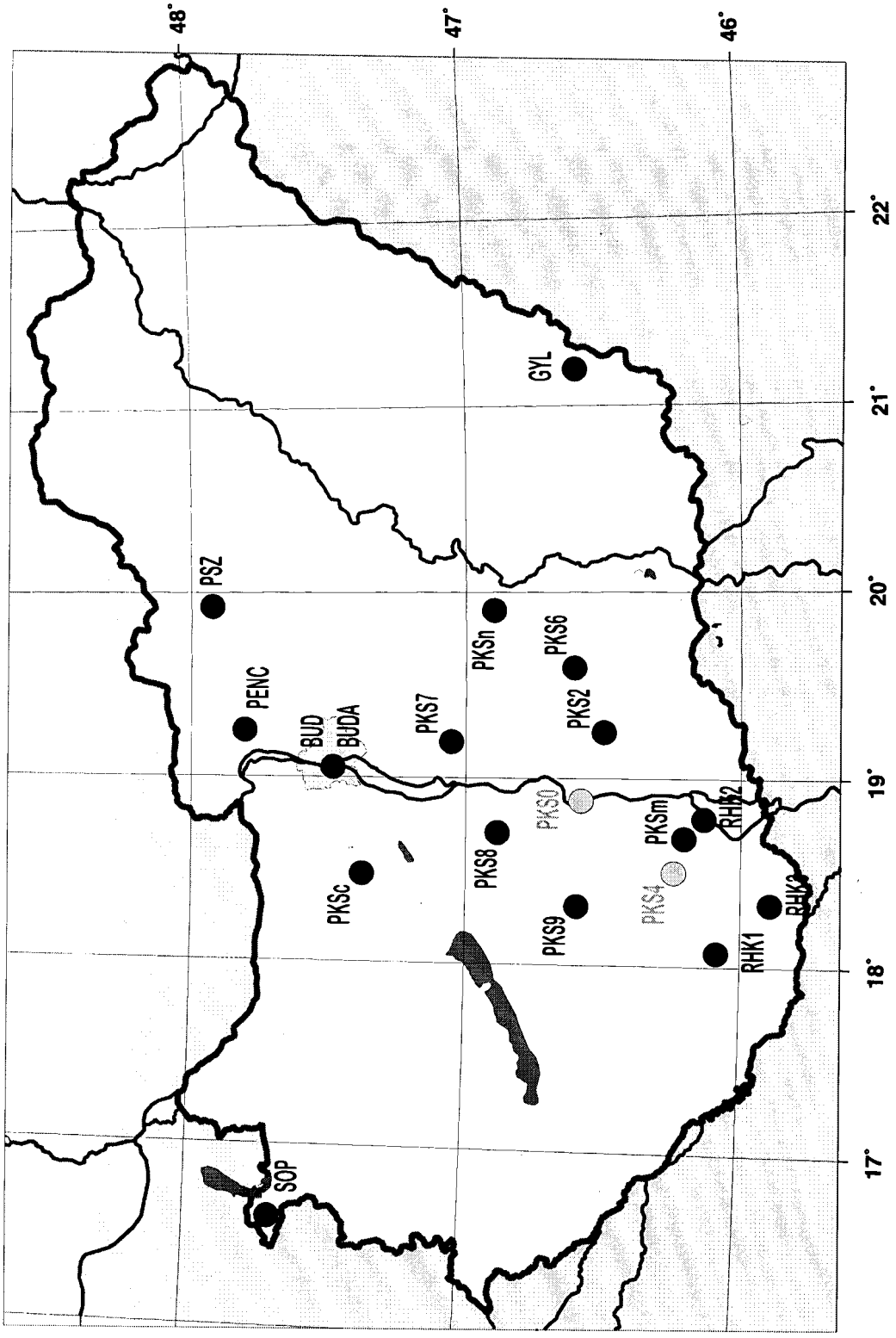


Figure 2.1. *Seismograph stations in Hungary*
(See Table 2.1. for details)

Seismograph Stations

Table 2.2. *Strong motion accelerograph stations*

Code	Latitude (N)	Longitude (E)	Elevation (m)	Foundation	Type of station (1)	Sensor type (2)	Recording (3)	Org. (4)
ALGY	46.3332	20.2092	90	loose sand	3C SM	AC-23	D - E	GR
BOD	47.322	18.241	250	limestone	3C SM	AC-23	D - E	GR
BPGY	47.4836	19.0239	196	dolomite	3C SM	AC-23	D - E	GGKI
PAKB	46.5743	18.8587	100	sand	3C SM	AC-23	D - E	PART
PAKK	46.5743	18.8449	100	loose sand	3C SM	AC-23	D - E	GGKI
TLK*	47.5500	18.8300	220	limestone	3C SM	AC-23	D - E	GGKI

(1) 3C - three component seismometer
SM - strong motion accelerograph

(2) AC-23 - triaxial accelerometer package (full scale 0.5g)

(3) D - digital, E - event recording

(4) GGKI - Geodetic and Geophysical Research Institute, GR - GeoRisk Ltd., PART - Paks Nuclear Power Plant Ltd.

(*) TLK on date 1999/01/10

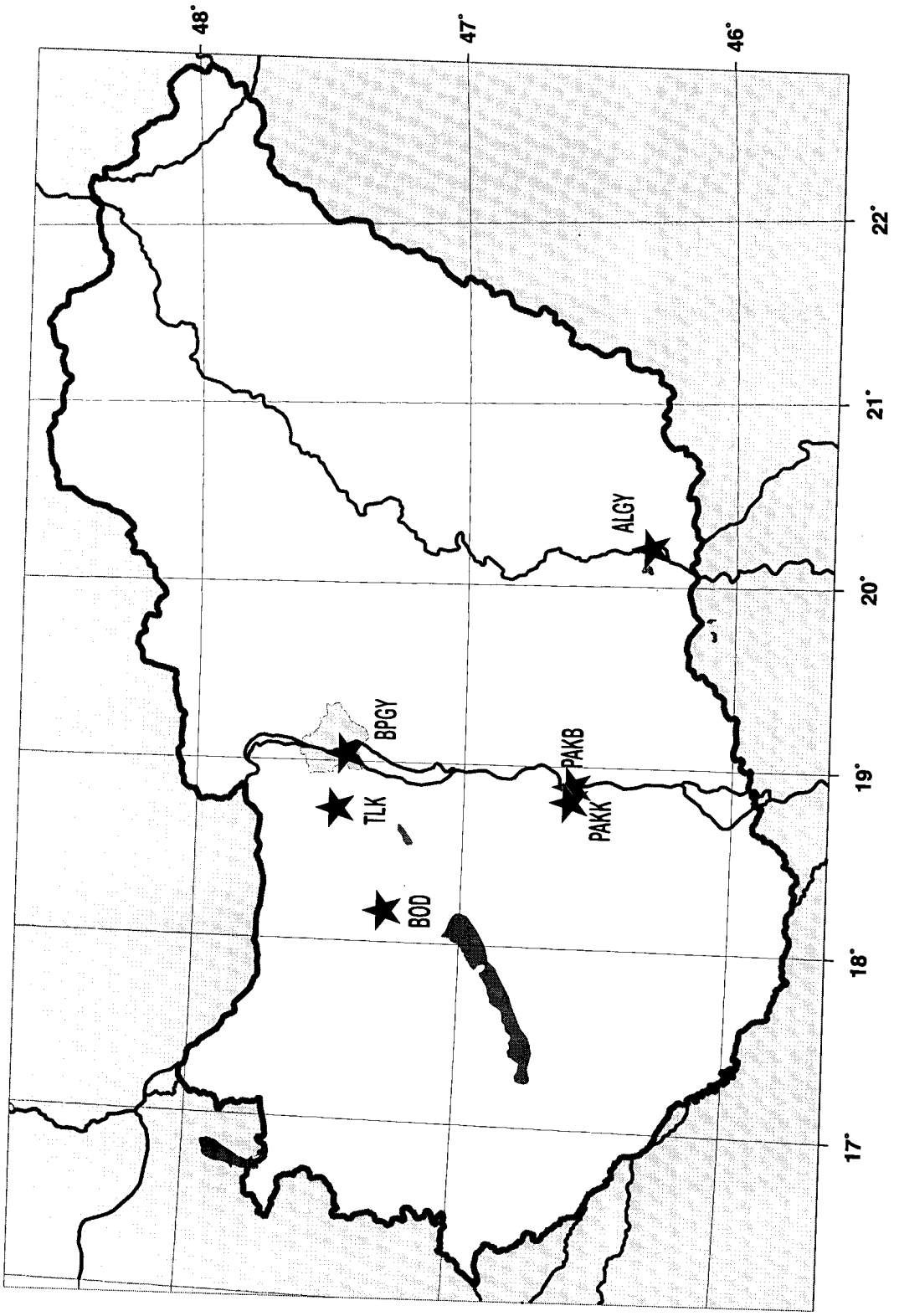


Figure 2.2. *Strong motion accelerograph stations in Hungary (See Table 2.2. for details)*

Seismograph Stations

PAKS MICRO-SEISMIC MONITORING NETWORK

The system comprises of a network of eight seismometer stations, located within a radius of about 100 km from the Power Plant at Paks (situated in the center of Hungary) and one additional station in Budapest where the data center is set up and collected data analyzed (Tóth and Mónus, 1997).

The field stations each consist of a three component short period seismometer located in a pit, with a digital recorder and time signal receiver housed nearby in a heat insulated steel container building.

The seismometers used are the LE-3D three directional compact size high sensitivity 1 Hz geophones. The digital acquisition system is the MARS-88 recorder that uses 20 bit AD converters sampling the data 125 times per second. The recorder also performs signal detection by its internal STA/LTA algorithm. The stations store event and continuous monitor channel data on rewritable magneto-optical disks, which are collected and transferred to the data center on a weekly basis. Most of the stations are powered by solar panels, and absolute time is provided by DCF-77 time code receivers.

At the data center a SUN SPARC workstation with large on-line disk capacity serves as a powerful tool for the routine data processing and analysis. Lennartz M88 database software is used for the data management and XPITSA for advanced seismogram analysis. All recorded data are archived on CDs. Both waveform and bulletin data are available over the INTERNET for authorized remote users.

The *PAKS micro-seismic monitoring network* is currently operated and its data processed and analyzed by *GeoRisk Ltd.*

Extensive noise survey has been carried out at those station sites where magneto-optical disks storage allowed to store large amount of data. Noise segments of 3 minutes has been recorded with 11 hours shifts. Figure 2.3. shows the vertical components of the very long term averaged (near to one year) noise power spectra. There is a clear separation of the rocky sites (PKSm, PKSc and PKS8) from those of having loose sediments (PKSn, PKS2, PKS6, PKS7, PKS9).

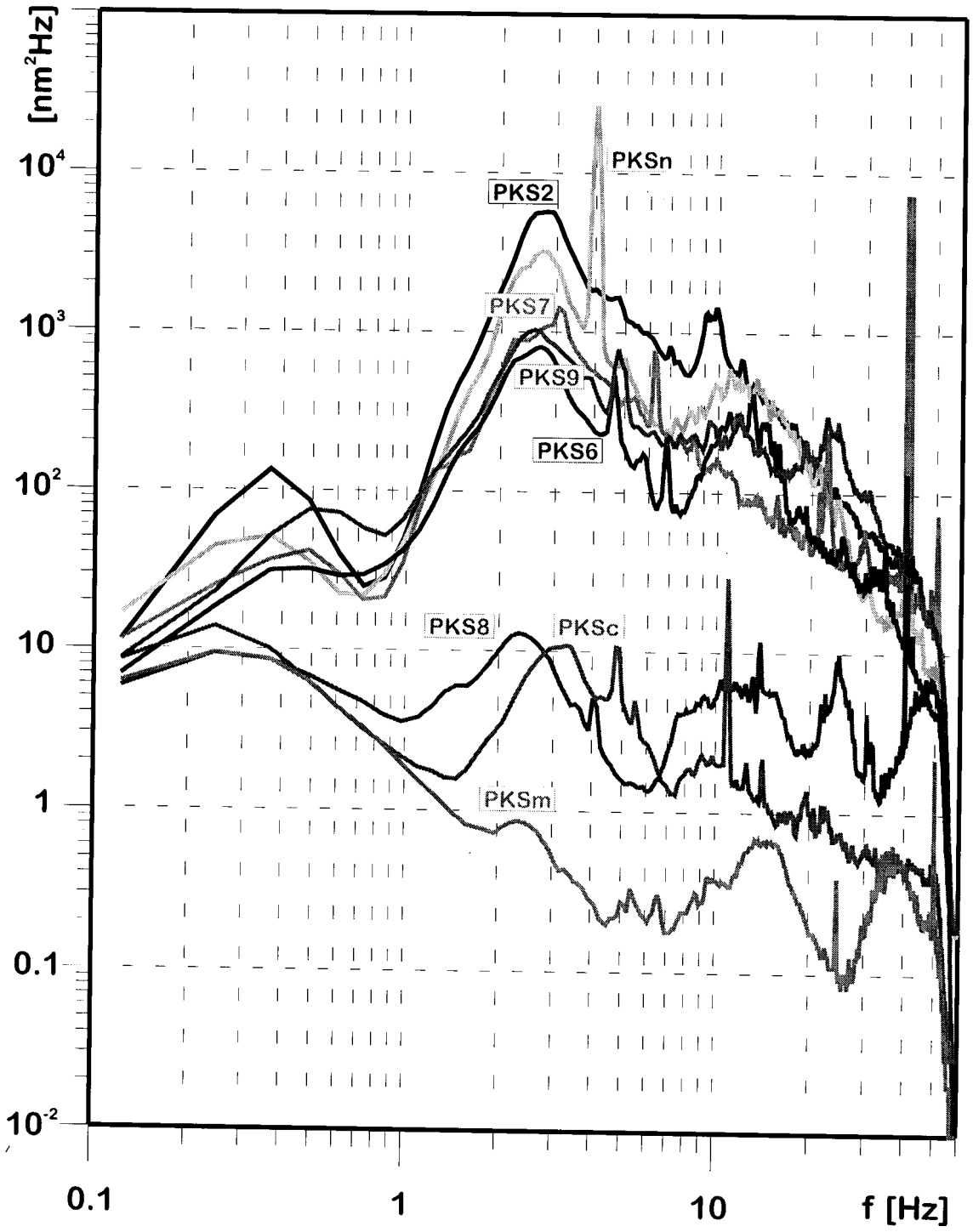


Figure 2.3. *Average noise power spectra for some stations. (See text for details)*

Seismograph Stations

ÜVEGHUTA MICRO-SEISMIC MONITORING NETWORK

Two relocated stations from the PAKS network and one additionally installed station forms the *Üveghuta micro-seismic monitoring network.*

The system comprises of a network of three seismometer stations, located in the potential nuclear waste disposal vicinity at Üveghuta (situated in southern part of Hungary).

The field stations hardware are just like the PAKS stations, each consist of a three component short period seismometer, with a digital recorder and time signal receiver housed in a nearby building.

The stations are accessible over commercial telephone lines. Event data are collected and transferred to the Budapest data center on a daily basis and analyzed jointly with the Paks network data.

The network is currently operated and its data processed and analyzed by *GGKI* and *GeoRisk Ltd.*

STATIONS OPERATED BY GGKI

During 1999 *GGKI* operated three digital and one analogue seismological stations.

Station *Piszkés (PSZ)* has been installed as an 'Open Station' under a cooperation between the Ministries for Foreign Affairs of Hungary and of Germany with the primary goal of nuclear test ban monitoring (Tóth, 1992). The station is equipped with a triaxial Streckeisen STS-2 broad-band seismometer and Quanterra's data acquisition system with a 24 bit, 80 Hz high resolution digitizer. Three component continuous data streams are recorded in circular buffers on magnetic disks and archived on tape cartridge. Continuous data is available on-line for more than a month. All data can be accessed directly and retrieved either in interactive or automatic mode. In 1999 PSZ also contributed data to GEOFON Project.

GYL and SOP are three component short period stations installed in 1994. Kinemetrics SSR-1 16bit digitizers and event recorders sample and record the output of three component SS-1 Ranger seismometers. Data of recorded events are collected via commercial telephone links.

A long period analogue recording seismograph has been operated at the *Seismological Observatory* in Budapest mostly for demonstration purposes.

STRONG MOTION STATIONS

Although the six strong motion accelerograph stations belong to three different organizations, they are all equipped with the same instrumentation: AC-23 triaxial accelerometer package (full scale 0.5g) and an SM-2 digital event recorder (manufactured by SIG^{SA}, Switzerland).

During 1999, we had access to all of these stations.

Seismograph Stations

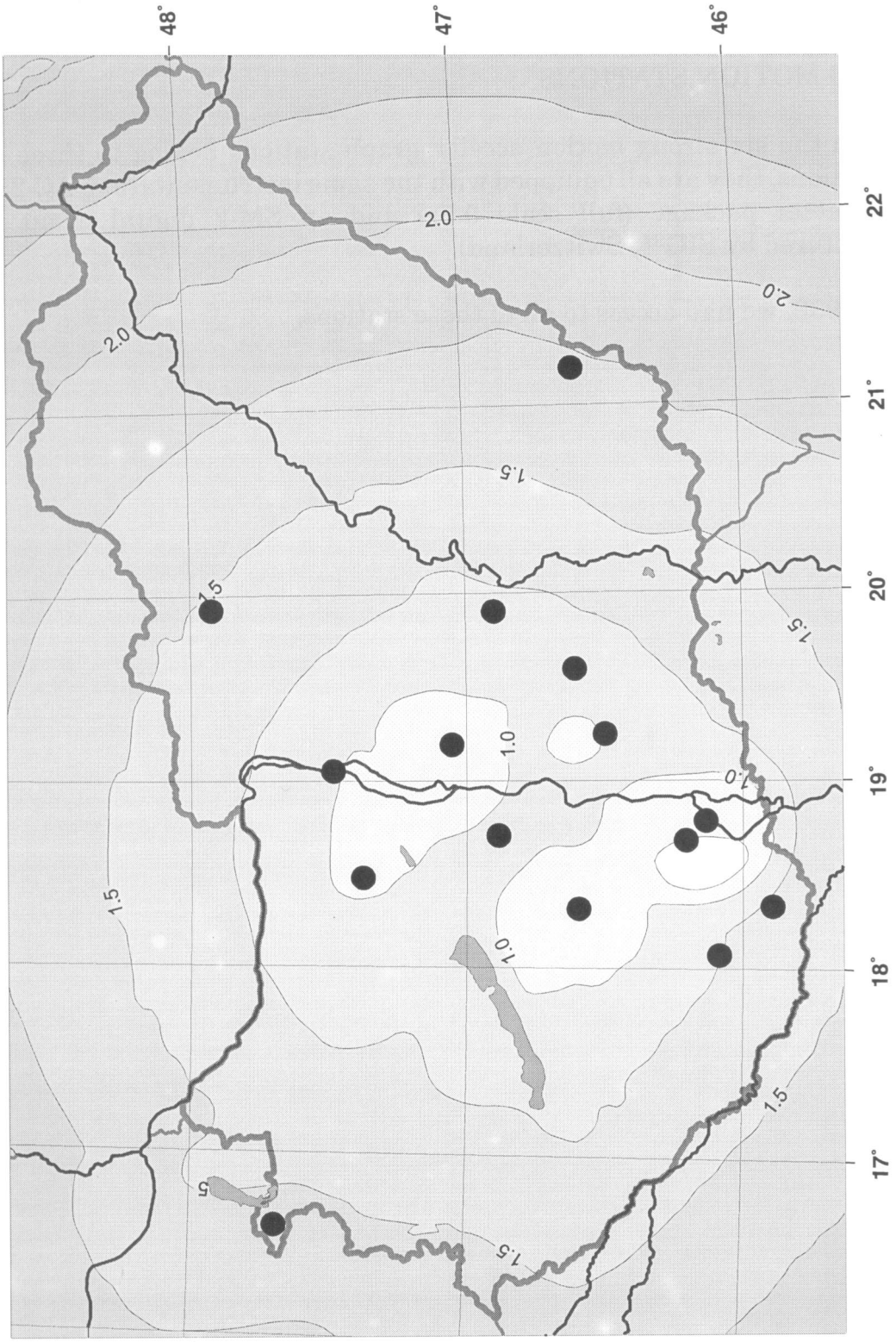


Figure 2.4. *Detection capability with average noise conditions. Contour values are Richter local magnitudes (ML).*

3.

List of Origins / Hypocenter Parameters

Hypocenter Parameters

METHOD FOR HYPOCENTER PARAMETER DETERMINATION

HYPO71PC (Lee and Lahr, 1975) was used for the routine calculation of hypocenter parameters. The original program has been modified and a routine for Richter local magnitude calculation implemented. For the magnitude calculations, the method published by Bakun and Joyner (1984) has been used.

The hypocenter parameters have been calculated using phase readings of seismological stations from Hungary and from the neighboring countries. However, a distance weighting has been applied, phase data from stations with epicenter distance greater than 450 km have been weighted out. In some cases, when enough P readings were available, S phase readings were not used in the calculations.

CRUSTAL VELOCITY MODEL

The three-layer crustal velocity model used in the hypocenter calculations has been derived from crustal phase travel times of several hundreds of local earthquakes (Mónus, 1995).

Velocity (vP) [km/s]	*Depth [km]*	*Thickness [km]*	*vP/vS*
5.60	0.0	20.0	1.78
6.57	20.0	11.0	
8.02	31.0	∞	

LIST OF EVENTS

Day	Origin time UTC hr mn sec	Geographic coordinates Lat	Long	Depth (km)	ML	I_{MAX} (EMS)	Locality/Region
JANUARY, 1999							
04	0:30:36.2	47.982N	22.850E	10	3.8	4.5	Nagyhódos
21	16:44:47.9	45.755N	21.335E	10	2.8	-	Romania
25	22:59:26.2	46.054N	17.427E	9	2.1	-	Somogyaracs
FEBRUARY, 1999							
01	8:38:27.9	45.652N	18.020E	10	3.0	-	Croatia
08	3:32:26.3	46.951N	19.066E	13	1.2	-	Szalkszentmárton
18	7:56:12.1	46.095N	17.605E	10	2.0	-	Kálmáncsa
MARCH, 1999							
07	11:03:10.0	46.983N	18.180E	18	1.7	-	Balatonaliga
31	11:38:06.3	46.240N	16.297E	7	3.4	-	Croatia
APRIL, 1999							
05	0:16:55.7	45.905N	19.216E	10	1.4	-	Yugoslavia
08	9:54:21.4	47.458N	18.478E	0	2.0	-	Vértes mt. (expl)
12	20:51:43.7	45.868N	19.207E	7	1.4	-	Yugoslavia
12	20:57:20.6	45.794N	19.177E	8	1.0	-	Yugoslavia
13	9:27:55.4	47.386N	18.449E	10	1.7	-	Vértes mt. (expl)
16	8:56:35.6	47.435N	18.462E	10	1.6	-	Vértes mt. (expl)
20	23:15:52.7	45.950N	16.006E	10	2.1	-	Croatia
21	1:35:17.5	45.903N	16.028E	9	2.2	-	Croatia
21	1:53:55.7	45.940N	16.029E	7	2.1	-	Croatia
24	14:47:55.9	46.233N	16.040E	8	2.4	-	Croatia
26	11:15:32.9	47.346N	18.767E	7	0.9	-	Tordas
28	10:07:44.1	47.477N	18.760E	1	0.7	-	Etyek
30	9:17:27.3	46.210N	16.031E	10	1.2	-	Croatia
MAY, 1999							
01	18:54:36.3	48.247N	17.212E	10	1.6	-	Slovakia
02	0:27:40.5	47.687N	16.142E	4	2.3	4.0	Austria
08	0:54:20.5	45.633N	19.004E	2	1.6	-	Yugoslavia
11	20:40:07.7	45.757N	19.067E	8	1.3	-	Yugoslavia

Hypocenter Parameters

14	11:02:00.3	47.136N	19.297E	10	1.8	-	Kunpeszér
17	10:35:04.9	47.478N	18.409E	10	1.8	-	Vértes mt.(expl)
20	18:23:30.0	48.312N	17.210E	4	1.5	-	Slovakia
22	1:45:48.5	45.694N	19.168E	7	1.6	-	Yugoslavia
22	2:13:44.8	45.661N	19.169E	8	1.9	-	Yugoslavia
24	1:02:42.9	45.868N	19.143E	7	1.3	-	Yugoslavia
JUNE, 1999							
04	2:09:45.1	45.826N	18.302E	10	3.0	4.0	Siklós
07	14:00:03.4	47.108N	19.189E	10	1.8	-	Apaj
09	14:28:57.6	47.458N	16.490E	10	1.3	-	Austria
16	4:50:45.8	46.055N	16.842E	10	2.0	-	Croatia
17	5:22:21.3	46.139N	16.936E	1	3.1	-	Croatia
20	7:46:28.6	45.857N	18.111E	8	1.8	-	Rádfalva
20	8:13:35.8	45.843N	18.211E	10	1.6	-	Harkány
20	14:28:31.3	47.405N	18.507E	6	1.8	-	Csákvár
24	9:55:07.8	47.477N	18.518E	10	1.4	-	Vértes mt. (expl)
28	20:20:26.5	46.743N	21.307E	10	2.0	-	Tarhos
29	2:00:29.8	46.804N	21.240E	7	1.9	-	Sarkad
JULY, 1999							
17	0:40:35.3	45.959N	17.790E	10	1.9	-	Szentegát
26	5:50:33.7	47.821N	16.483E	10	3.1	4.0	Austria
AUGUST, 1999							
03	6:51:38.0	48.062N	21.336E	15	2.8	5.0	Taktabáj
16	0:17:02.2	46.768N	20.879E	12	2.3	-	Kondoros
19	22:22:49.5	45.824N	17.867E	13	2.3	-	Sósvertike
22	12:03:35.4	47.847N	18.132E	8	2.0	-	Slovakia
SEPTEMBER, 1999							
03	9:38:19.1	46.590N	21.121E	18	3.4	3.0	Békés
06	9:53:30.5	47.478N	18.494E	6	1.7	-	Vértes mt. (expl)
07	20:30:00.0	46.809N	17.954E	0	1.4	-	Bálványos (expl)
08	1:06:12.0	45.945N	16.120E	10	2.4	-	Croatia
09	6:15:58.7	45.819N	18.173E	3	1.9	-	Drávacsehi
09	20:29:56.6	46.406N	16.619E	0	1.4	-	Oltárc (expl)
09	20:45:00.5	47.606N	16.939E	0	1.4	-	Fertőd (expl)
09	20:59:59.8	46.106N	18.695E	10	1.7	-	Dunaszekcső(expl)
10	15:54:09.7	46.219N	16.014E	1	2.4	-	Croatia

Hypocenter Parameters

OCTOBER, 1999							
03	4:43:40.2	45.772N	20.860E	1	3.0	-	Romania
08	17:26:14.3	45.512N	20.957E	10	2.9	-	Romania
09	10:51:34.0	46.035N	18.001E	0	2.0	-	Szabadszentkirály
09	20:49:17.1	45.623N	20.924E	10	2.7	-	Yugoslavia
11	2:56:29.2	46.263N	18.930E	10		-	Érsekcsanád
11	11:45:13.1	46.155N	19.190E	10	1.7	-	Bácsbokod
13	18:50:08.5	47.476N	18.750E	10	1.8	-	Etyek
13	18:50:17.9	47.425N	18.920E	0	0.9	-	Törökbálint
13	18:50:28.2	47.426N	18.825E	4	1.4	-	Sóskút
13	18:50:45.3	47.493N	18.830E	10	0.5	-	Biatorbágy
13	18:53:29.6	47.425N	18.852E	8	1.3	-	Sóskút
13	20:23:01.2	47.377N	18.987E	0	0.9	-	Halásztelek
13	20:23:19.1	47.374N	19.045E	8	1.0	-	Halásztelek
15	18:16:13.9	46.659N	18.454E	0	1.3	-	Pincehely
16	2:55:40.2	47.889N	19.360E	3	1.8	-	Szécsénke
18	4:08:18.2	48.363N	17.712E	1		-	Slovakia
28	16:06:48.7	48.316N	19.007E	10	2.9	-	Slovakia
29	18:37:04.6	48.325N	19.004E	10	2.6	-	Slovakia
NOVEMBER, 1999							
19	11:10:02.7	47.479N	18.359E	0	1.6	-	Vértes mt. (expl)
19	19:19:16.9	47.381N	18.250E	10	0.9	-	Mór
29	15:12:14.6	45.867N	16.034E	8	2.8	-	Croatia
DECEMBER, 1999							
03	10:08:48.1	47.458N	18.555E	5	1.6	-	Vértes mt. (expl)
14	1:58:19.9	46.239N	16.312E	10	2.7	-	Croatia
15	11:03:43.4	47.456N	18.497E	4	1.4	-	Vértes mt. (expl)

Hypocenter Parameters

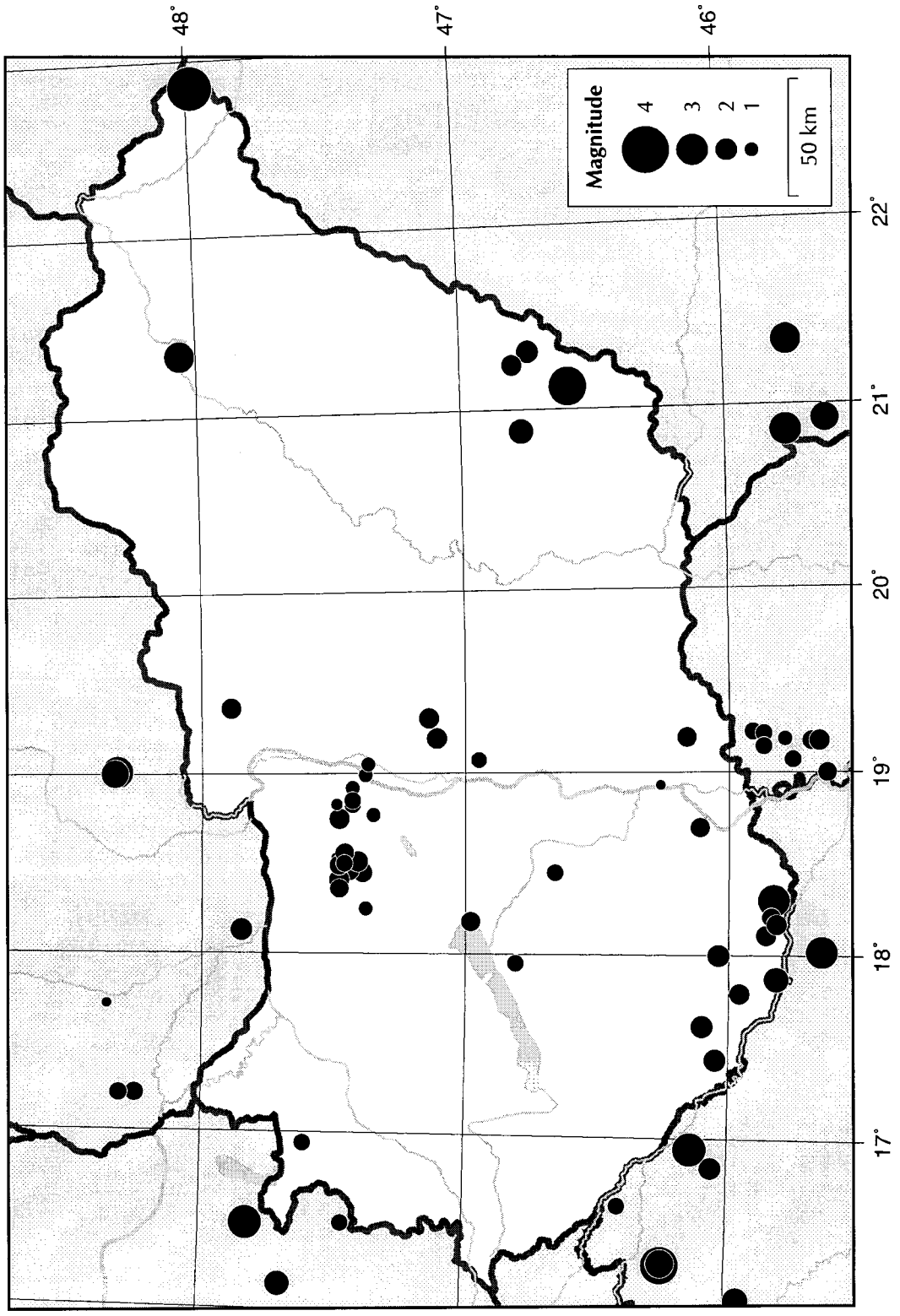


Figure 3.1. *Epicenters of 1999 earthquakes*

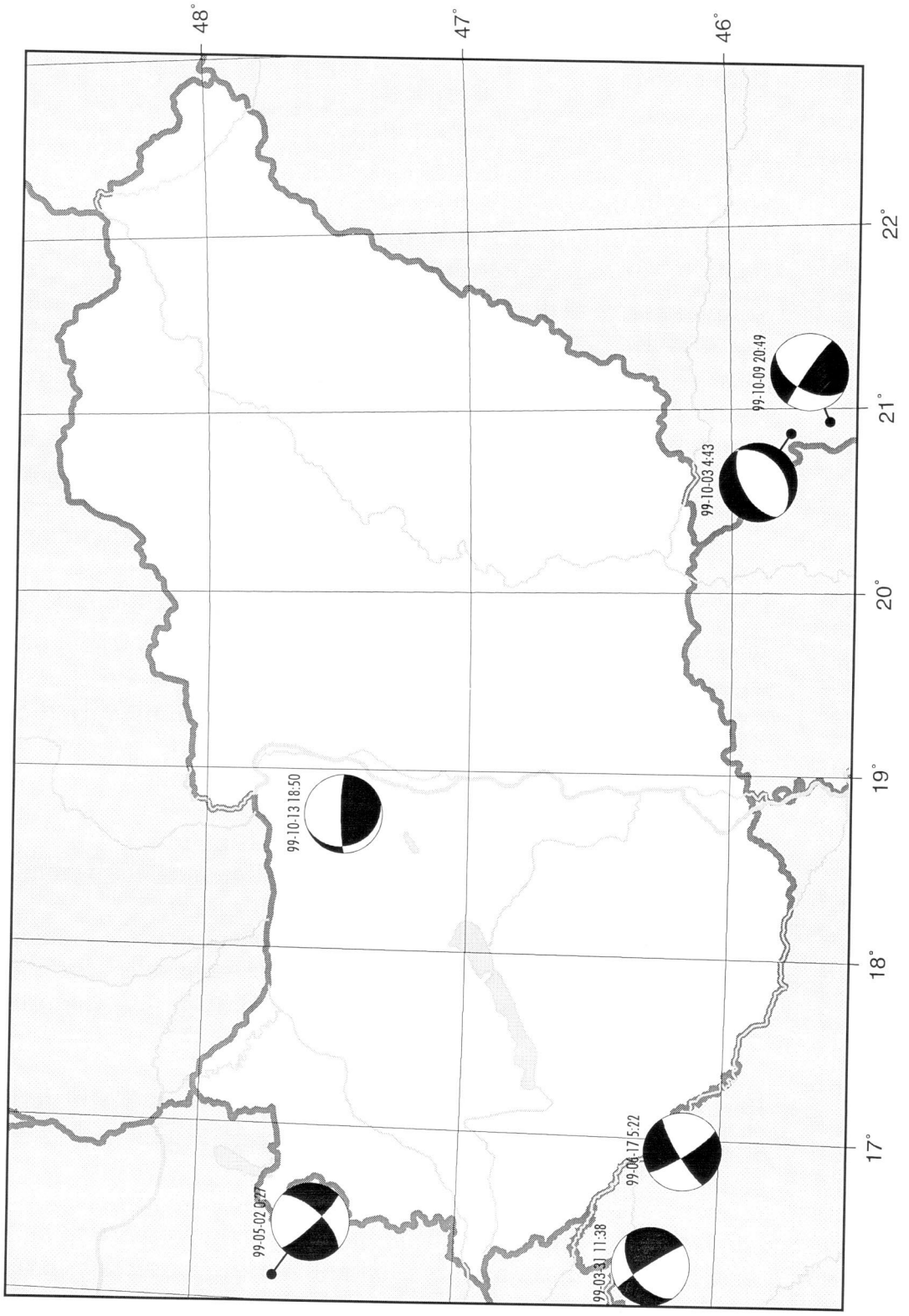


Figure 3.2. *Fault plane solutions of 1999 earthquakes*

Hypocenter Parameters

PHASE DATA

Key to phase data encoding

time:	Time of occurrence of event in hours, mins and secs (UTC).
ML:	Richter local magnitude of the earthquake.
lat:	Latitude of the event in degrees.
lon:	Longitude of the event in degrees.
h:	Depth of the hypocenter in km.
erh:	Standard error of the epicenter in km. ($erh = \sqrt{SDX^2 + SDY^2}$, where SDX and SDY are the standard errors in latitude and longitude respectively, of the epicenter.) If erh = ---, this means that erh could not be computed because of insufficient data.
erz:	Standard error of the focal depth in km. If erz = ---, this means that erz could not be computed either because focal depth is fixed in the solution or because of insufficient data.
nr:	Number of station readings used in locating the earthquake. P and S arrivals for the same stations are regarded as 2 readings.
gap:	Largest azimuthal separation in degrees between stations.
rms:	Root mean square error of time residuals in seconds. ($rms = \sqrt{\Sigma R_i^2 / nr}$, where R_i is the time residual of the i^{th} station.)
Locality:	A geographical indication of the epicenter area, usually the nearest settlement.
Comments:	Additional comments about the event, eg. maximum EMS intensity
sta:	Station name. (For details see Chapter 2.)
dist:	Distance from earthquake epicenter to station in km.
azm:	Azimuthal angle between epicenter to station measured from North in degrees.
phase:	Phase identifier; the first letter characterizes onset e = emergent i = impulsive, the second and third indicate the phase eg. Pn, Pg, Sn and Sg, the forth indicates the polarity C=compression/up D=dilatation/down.
hr mn sec:	Arrival time of the phase from input data.
res:	Residual of the phase in secs. ($res = T_{obs} - T_{cal}$, where T_{obs} is the observed and T_{cal} is the calculated travel time respectively.)

Fault plane solutions were attempted for each event where any information for the stress field could be drawn. Stereographic projections of the lower focal hemisphere are shown, P and T are the main compression and tension axes respectively.

Hypocenter Parameters

1.

1999-01-04 time: 0:30:36.17 UTC ML= 3.8
lat: 47.982N lon: 22.850E h= 10.0 km
erh= 6.4km erz= 592km
nr= 16 gap=209 rms=0.51
Locality: Nagyhódos
Comments: felt 4.5 EMS

sta	dist	azm	phase	hr mn sec	res
CEI	44.1	222	eSg	0:31:06.00	15.45
BMR	59.4	125	eSg	0:31:13.00	17.69
GYL	199.6	220	iPnU	0:31:07.30	0.49
			iSn	31:38.40	7.68
PSZ	220.9	268	iPnD	0:31:09.75	0.29
			iSn	31:42.35	6.91
PKSN	255.3	242	iPnC	0:31:14.10	0.35
PENC	267.7	265	ePnU	0:31:15.58	0.28
BZS	279.3	200	iPnD	0:31:17.00	0.26
			eSn	31:59.90	11.51
PKS6	292.2	238	iPnC	0:31:18.30	-0.05
			iSn	31:51.40	0.14
BUD	292.3	259	ePn	0:31:18.97	0.60
PKS7	296.7	249	iPnC	0:31:18.70	-0.21
MTUR	350.1	151	iPnD	0:31:33.80	8.22
			eSn	31:18.43	-45.69
SNX	356.2	145	ePnU	0:31:26.44	0.11
			eSn	32:19.97	14.50
MLR	364.1	140	iPnU	0:31:26.89	-0.43
PKSM	375.3	238	iPnD	0:31:27.70	-1.01
			iSn	32:07.50	-2.20
PKS9	379.0	246	iPnC	0:31:28.70	-0.48
			iSn	32:09.50	-1.03
ISR	424.5	138	iPnD	0:31:40.41	5.56
ZST	428.9	273	ePn	0:31:34.20	-1.19
			eSn	32:45.10	23.51
ARSA	556.8	262	iPnC	0:31:51.20	-0.15
MOA	641.8	269	iPnC	0:32:01.70	-0.25
PRU	647.8	290	ePn	0:32:06.00	3.31
			Sn	33:10.70	0.51
KHC	696.3	281	ePn	0:32:08.00	-0.74
			Sn	33:25.00	4.05

2.

1999-01-21 time: 16:44:47.89 UTC ML= 2.8
lat: 45.755N lon: 21.335E h= 10.0 km
erh= 287km erz= 275km
nr= 10 gap=333 rms=1.25
Locality: Romania
Comments:

sta	dist	azm	phase	hr mn sec	res
PKS6	165.8	304	iPnD	16:45:14.90	0.57
			iSn	45:35.60	0.66
PKSM	214.8	284	iPnC	16:45:19.50	-0.93
			eSn	45:50.00	4.19
PKS7	220.4	311	ePn	16:45:22.20	1.07
			iSn	45:46.50	-0.56
PKS8	239.8	301	iPnC	16:45:23.50	-0.05
			iSn	45:49.30	-2.07
PKS9	253.5	291	eSn	16:46:02.60	8.21
ARSA	476.1	290	iPnC	16:45:49.90	-3.11
			iSn	46:42.50	-1.30

3.

1999-01-25 time: 22:59:26.21 UTC ML= 2.1
lat: 46.054N lon: 17.427E h= 9.2 km
erh= 4.5km erz= 8.1km
nr= 5 gap=171 rms=0.22
Locality: Somogyaracs
Comments:

sta	dist	azm	phase	hr mn sec	res
PKS9	88.4	48	iPgD	22:59:42.00	-0.08
			iSg	59:54.70	0.24
PKSM	95.5	79	iPgC	22:59:43.10	-0.24
			eSg	59:58.20	1.50
VBY	179.5	250	iPn	22:59:54.60	0.15

4.

1999-02-01 time: 8:38:27.90 UTC ML= 3.0
lat: 45.652N lon: 18.020E h= 10.0 km
erh=68.2km erz=71.2km
nr= 11 gap=228 rms=1.43
Locality: Croatia
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	78.7	38	iPgD	8:38:41.90	-0.17
			iSg	38:58.60	5.48
CESS	201.9	280	iPn	8:38:57.80	-1.02
			iSn	39:30.40	7.45
DOBS	205.5	286	iPn	8:38:57.50	-1.77
			iSn	39:32.80	9.05
VBY	216.3	266	iPn	8:39:00.50	-0.12
			iSn	39:29.30	3.16
BUD	217.7	21	iPn	8:39:09.00	8.21
			iSn	39:39.60	13.15
BISS	249.4	296	iPn	8:39:03.60	-1.14
ARSA	261.5	313	iPnC	8:39:06.90	0.65
			iSn	39:41.70	5.53
LJU	274.7	279	ePn	8:39:08.20	0.29
			eSn	39:48.00	8.88
CEY	280.0	272	iPn	8:39:11.80	3.23
			iSn	39:49.80	9.51
ZST	291.3	346	ePn	8:39:12.50	2.52
			eSn	39:54.50	11.70
MOA	376.7	310	iPnC	8:39:21.60	0.97
			iSn	40:07.30	5.54
KBA	393.1	294	iPnD	8:39:25.80	3.13
			iSn	40:13.70	8.30
SQTA	551.7	288	iPnC	8:39:42.70	0.26

5.

1999-02-08 time: 3:32:26.27 UTC ML= 1.2
lat: 46.951N lon: 19.066E h= 13.4 km
erh= ---km erz= ---km
nr= 4 gap=189 rms=0.00
Locality: Szalkszentmárton
Comments:

sta	dist	azm	phase	hr mn sec	res
PKS7	12.9	34	iPgD	3:32:29.60	0.00
			iSg	32:30.20	-1.99
PKS6	54.6	136	iPgC	3:32:36.30	0.00
			iSg	32:37.90	-6.23
PKSM	88.4	202	e *C	3:32:42.20	0.00
			eS*	32:52.10	-2.53
PSZ	124.4	30	ePn	3:32:47.10	0.01
			iSn	33:03.90	0.56

Hypocenter Parameters

6.

1999-02-18 time: 7:56:12.06 UTC ML= 2.0
lat: 46.095N lon: 17.605E h= 10.0 km
erh=18.6km erz=22.7km
nr= 8 gap=185 rms=1.40
Locality: Kálmáncsa
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	81.1	81	iPgC	7:56:26.70	0.04
			iSg	56:37.60	-0.44
DOBS	165.2	272	eSn	7:56:57.60	-1.36
CESS	166.3	265	eSn	7:56:59.00	-0.22
ARSA	204.6	309	iPnC	7:56:46.40	3.07
			iSn	57:06.30	-1.41
MOA	320.3	308	iPnC	7:56:56.40	-1.35
			iSn	57:31.10	-2.29
KBA	344.3	289	iSn	7:57:18.80	-19.92

7.

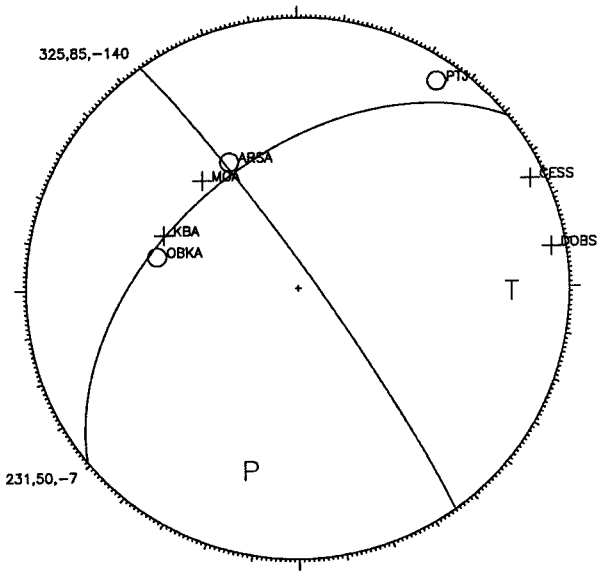
1999-03-07 time: 11:03:10.02 UTC ML= 1.7
lat: 46.983N lon: 18.180E h= 17.9 km
erh= 4.8km erz= 2.7km
nr= 8 gap=274 rms=0.38
Locality: Balatonaliga
Comments:

sta	dist	azm	phase	hr mn sec	res
PKS9	44.6	170	iPgC	11:03:18.20	-0.41
			iSg	03:25.70	0.39
PKS7	74.9	84	iP*C	11:03:23.70	0.21
			eS*	03:33.80	-0.20
PKSM	92.7	158	iP*D	11:03:25.90	-0.30
			eS*	03:38.10	-0.71
PKS2	96.0	125	iP*C	11:03:27.20	0.50
			eS*	03:39.40	-0.30

8.

1999-03-31 time: 11:38:06.33 UTC ML= 3.4
lat: 46.240N lon: 16.297E h= 6.9 km
erh= 4.2km erz= 2.8km
nr= 21 gap=235 rms=0.79
Locality: Croatia
Comments:

sta	dist	azm	phase	hr mn sec	res
PTJ	44.5	214	iPgD	11:38:14.00	-0.38
			iSg	38:19.90	-0.75
ZAG	51.4	207	iPg	11:38:15.60	0.02
			iSg	38:23.30	0.50
DOBS	64.7	261	iPgC	11:38:17.91	-0.04
CESS	71.0	245	iPgC	11:38:19.09	0.03
			eSg	38:29.00	0.01
BISS	100.7	297	ePg	11:38:25.31	0.96
VBY	114.9	225	iPn	11:38:25.83	-0.98
ARSA	126.9	332	iPnD	11:38:28.20	-0.10
			iSn	38:44.30	-1.14
OBKA	137.8	283	iPnD	11:38:29.70	0.04
			iSn	38:47.80	-0.05
LJU	138.5	261	ePn	11:38:30.15	0.41
			eSn	38:47.50	-0.50
CEY	155.3	249	iPn	11:38:31.86	0.03
VOY	187.2	263	ePn	11:38:37.00	1.19
			eSn	39:01.20	2.39
MOA	236.3	319	iPnC	11:38:43.00	1.06
			iSn	39:10.10	0.39
KBA	244.4	292	iPnC	11:38:50.20	7.25
			iSn	39:21.70	10.18



9.

1999-04-05 time: 0:16:55.72 UTC ML= 1.4
lat: 45.905N lon: 19.216E h= 10.0 km
erh= 5.7km erz= 3.3km
nr= 6 gap=288 rms=0.38
Locality: Yugoslavia
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	56.0	307	iPgC	0:17:05.40	-0.48
			iSg	17:14.30	0.50
PKS2	65.2	360	iPgC	0:17:07.60	0.10
			eSg	17:20.80	4.11
PKS6	81.7	19	iSg	0:17:21.90	0.00
PKS9	104.7	316	iP*C	0:17:14.80	0.34
			iS*	17:28.60	-0.47

10.

1999-04-08 time: 9:54:21.44 UTC ML= 2.0
lat: 47.458N lon: 18.478E h= 0.1 km
erh= ---km erz= ---km
nr= 4 gap=335 rms=0.84
Locality: Vértes mt.
Comments: (explosion)

sta	dist	azm	phase	hr mn sec	res
PKSC	9.2	200	iPgC	9:54:22.80	-0.27
			iSg	54:24.10	-0.25
PKS9	98.1	189	iPgC	9:54:39.30	0.36
PKSM	139.1	175	ePnD	9:55:01.80	15.99

11.

1999-04-12 time: 20:51:43.72 UTC ML= 1.4
lat: 45.868N lon: 19.207E h= 6.7 km
erh= 2.8km erz= 2.2km
nr= 6 gap=292 rms=0.16
Locality: Yugoslavia
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	58.1	311	iPgC	20:51:54.00	-0.17
			eSg	52:02.40	0.07
PKS2	69.4	0	iPgC	20:51:56.40	0.23
PKS6	85.9	19	ePg	20:51:58.90	-0.21

		eSg	52:11.00	-0.12
PKS8	119.6	340	iPn	20:52:04.90	0.09

12.

1999-04-12 time: 20:57:20.61 UTC ML= 1.0
lat: 45.794N lon: 19.177E h= 7.5 km
erh= 2.6km erz= 1.2km
nr= 8 gap=300 rms=0.21
Locality: Yugoslavia
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	62.3	318	iPgC	20:57:31.90	0.08
			eSg	57:40.20	-0.36
PKS6	94.5	18	iPgC	20:57:37.40	-0.14
			eSg	57:51.20	0.46
PKS9	112.2	322	ePnC	20:57:40.80	0.13
			eSn	57:56.80	0.48
PKS8	126.6	342	iPnC	20:57:42.40	-0.07
			eSn	57:59.20	-0.32
PKSN	133.7	23	ePn	20:57:40.90	-2.45

13.

1999-04-13 time: 9:27:55.38 UTC ML= 1.7
lat: 47.386N lon: 18.449E h= 10.0 km
erh= ---km erz= ---km
nr= 4 gap=297 rms=0.53
Locality: Vértes mt.
Comments: (explosion)

sta	dist	azm	phase	hr mn sec	res
PKSC	1.1	237	iPgC	9:27:57.20	0.02
			iSg	27:57.90	-0.68
PKSM	131.4	174	iPn	9:28:18.20	0.68
			eSn	28:34.30	-0.48

14.

1999-04-16 time: 8:56:35.56 UTC ML= 1.6
lat: 47.435N lon: 18.462E h= 10.0 km
erh= ---km erz= ---km
nr= 4 gap=337 rms=0.87
Locality: Vértes mt.
Comments: (explosion)

sta	dist	azm	phase	hr mn sec	res
PKSC	6.4	197	iPgC	8:56:37.40	-0.28
			iSg	56:38.90	-0.43
PKS9	95.3	188	iPgC	8:56:53.90	1.22
PKSM	136.7	174	eSn	8:57:14.80	-1.35

15.

1999-04-20 time: 23:15:52.71 UTC ML= 2.1
lat: 45.950N lon: 16.006E h= 10.0 km
erh= 9.1km erz= 6.1km
nr= 12 gap=244 rms=1.45
Locality: Croatia
Comments:

sta	dist	azm	phase	hr mn sec	res
CESS	42.2	274	iPgC	23:16:01.50	1.05
			iSg	16:07.46	0.98
DOBS	47.1	298	iPgC	23:16:01.69	0.39
			iSg	16:08.58	0.57
VBY	76.5	230	iPg	23:16:05.52	-0.97
			iSg	16:14.48	-2.76
BISS	103.0	319	iPg	23:16:10.80	-0.38
			iSg	16:23.92	-1.67
OBKA	128.5	299	iPnC	23:16:17.30	2.82
			iSn	16:32.20	0.74
ARSA	149.2	346	iPnC	23:16:18.40	1.33
			iSn	16:34.20	-1.87

16.

1999-04-21 time: 1:35:17.55 UTC ML= 2.2
lat: 45.903N lon: 16.028E h= 9.1 km
erh= 3.3km erz= 1.4km
nr= 16 gap=238 rms=0.63
Locality: Croatia
Comments:

sta	dist	azm	phase	hr mn sec	res
PTJ	4.3	278	iPgD	1:35:18.90	-0.44
			iSg	35:21.20	0.46
ZAG	8.7	198	iPgD	1:35:19.20	-0.59
			iSg	35:21.90	0.36
CESS	44.5	280	iPg	1:35:26.27	0.62
			iSg	35:32.52	0.55
DOBS	51.2	302	iPg	1:35:26.91	0.08
			iSg	35:33.09	-0.98
VBY	74.6	234	iPg	1:35:30.68	-0.30
			eSg	35:40.47	-0.98
BISS	108.0	320	eP*	1:35:35.88	-0.99
			eS*	35:48.41	-3.54
CEY	125.8	262	iPn	1:35:39.61	0.51
			eSn	35:55.60	-0.31
OBKA	132.5	301	iPnD	1:35:41.20	1.26
			iSn	35:57.30	-0.11

17.

1999-04-21 time: 1:53:55.66 UTC ML= 2.1
lat: 45.940N lon: 16.029E h= 7.5 km
erh= 3.7km erz= 1.8km
nr= 16 gap=234 rms=0.75
Locality: Croatia
Comments:

sta	dist	azm	phase	hr mn sec	res
PTJ	5.6	232	iPgD	1:53:57.00	-0.33
			iSg	53:59.20	0.57
ZAG	12.6	193	iPgD	1:53:58.00	-0.29
			iSg	54:00.40	0.07
CESS	44.1	275	iPg	1:54:04.53	0.89
			eSg	54:10.65	0.78
DOBS	49.2	298	iPg	1:54:05.06	0.50
			iSg	54:11.35	-0.14
VBY	77.2	231	iPg	1:54:08.98	-0.54
			iSg	54:19.28	-1.04
BISS	105.0	319	ePg	1:54:14.42	-0.04
			iSg	54:27.24	-1.88
CEY	126.5	260	ePn	1:54:18.90	1.38
			iSn	54:34.02	-0.54
OBKA	130.6	299	iPnD	1:54:19.30	1.27
			iSn	54:35.50	0.03

18.

1999-04-24 time: 14:47:55.93 UTC ML= 2.4
lat: 46.233N lon: 16.040E h= 8.2 km
erh= 3.7km erz= 2.7km
nr= 19 gap=207 rms=0.87
Locality: Croatia
Comments:

sta	dist	azm	phase	hr mn sec	res
PTJ	36.4	188	iPg	14:48:02.80	0.21
			iSg	48:07.10	-0.68
DOBS	45.0	258	iPgC	14:48:04.21	0.11
			iSg	48:10.99	0.51

Hypocenter Parameters

CESS	53.1	237	iPg	14:48:05.53	0.00
			iSg	48:12.68	-0.33
BISS	83.9	303	iPg	14:48:11.09	0.10
			iSg	48:13.19	-9.55
VBY	101.3	217	iPg	14:48:13.73	-0.34
			iSg	48:27.91	-0.31
LJU	118.8	260	iPn	14:48:16.40	-0.32
			iSn	48:33.08	0.14
OBKA	118.8	285	iPnC	14:48:17.10	0.38
			iSn	48:31.50	-1.44
ARSA	119.8	341	iPnD	14:48:17.70	0.85
			iSn	48:31.80	-1.37
CEY	136.6	246	iPn	14:48:19.78	0.84
VOY	167.4	262	ePn	14:48:24.70	1.92
			eSn	48:47.00	3.27

19.

1999-04-26 time: 11:15:32.93 UTC ML= 0.9
lat: 47.346N lon: 18.767E h= 7.0 km
erh=22.5km erz=19.9km
nr= 6 gap=226 rms=0.52
Locality: Tordas
Comments:

sta	dist	azm	phase	hr mn sec	res
BUD	24.7	52	iPg	11:15:36.90	-0.62
			iSg	15:41.50	0.40
PKSC	25.2	279	iPgD	11:15:37.40	-0.20
			eSg	15:41.30	0.06
PSZ	106.0	53	iPgC	11:15:52.50	0.60
			eSg	16:04.20	-2.50

20.

1999-04-28 time: 10:07:44.13 UTC ML= 0.7
lat: 47.477N lon: 18.760E h= 1.0 km
erh= 7.5km erz= 6.8km
nr= 6 gap=162 rms=0.17
Locality: Etyek
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSC	26.6	246	iPgC	10:07:48.90	0.02
			eSg	07:54.20	1.62
PENC	52.5	48	ePgD	10:07:53.10	-0.39
PSZ	98.3	60	iPgC	10:08:01.60	-0.08
			iSg	08:15.60	0.23
PKSM	141.0	184	iPnD	10:08:08.70	0.09
			eSn	08:27.70	0.00

21.

1999-04-30 time: 9:17:27.33 UTC ML= 1.2
lat: 46.210N lon: 16.031E h= 10.0 km
erh= 2.7km erz= 3.8km
nr= 9 gap=284 rms=0.38
Locality: Croatia
Comments:

sta	dist	azm	phase	hr mn sec	res
PTJ	33.8	188	iPg	9:17:34.00	0.38
			iSg	17:38.00	-0.53
DOBS	43.9	261	ePg	9:17:34.95	-0.41
			iSg	17:41.38	-0.25
CESS	51.2	239	iPg	9:17:36.76	0.12
			iSg	17:43.60	-0.31
VBY	98.8	217	ePg	9:17:45.73	0.66
			iSg	17:59.30	0.39
VOY	166.4	263	ePn	9:17:54.00	0.17
			eSn	18:18.80	4.30

22.

1999-05-01 time: 18:54:36.28 UTC ML= 1.6
lat: 48.247N lon: 17.212E h= 10.0 km
erh= 5.2km erz= 2.4km
nr= 12 gap=182 rms=0.83
Locality: Slovakia
Comments:

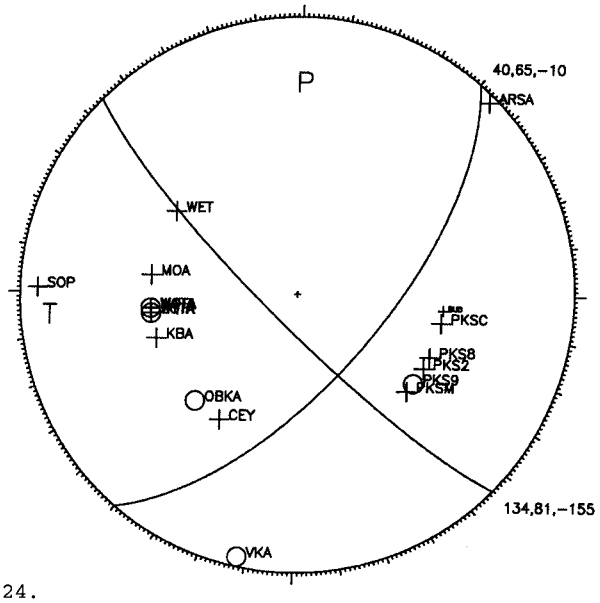
sta	dist	azm	phase	hr mn sec	res
ZST	9.9	235	Pg	18:54:38.60	-0.19
			Sg	54:41.80	1.05
SOP	79.4	218	iPgC	18:54:49.50	-1.07
			iSg	55:01.70	-0.02
PKSC	133.0	136	iPnC	18:54:59.10	0.48
			eSn	55:15.80	-0.24
ARSA	168.3	229	iPnC	18:55:03.70	0.69
			iSn	55:25.70	1.83
MOA	224.1	259	iPnC	18:55:08.90	-1.07
			iSn	55:35.40	-0.86
PKSM	250.8	154	iPnC	18:55:12.90	-0.40
PRU	274.8	315	eSn	18:55:48.00	0.48

23.

1999-05-02 time: 0:27:40.52 UTC ML= 2.3
lat: 47.687N lon: 16.142E h= 4.1 km
erh= 2.3km erz= 2.5km
nr= 21 gap= 80 rms=0.63
Locality: Austria
Comments: felt 4 EMS at Pitten, Austria

sta	dist	azm	phase	hr mn sec	res
SOP	31.3	91	iPgC	0:27:46.80	0.64
			iSg	27:50.50	-0.05
VKA	65.7	12	iPgD	0:27:52.00	-0.27
			iSg	28:01.00	-0.44
ARSA	67.2	224	iPgC	0:27:52.30	-0.25
			iSg	28:02.00	0.07
ZST	91.5	52	ePg	0:27:56.30	-0.57
BISS	138.7	214	iPn	0:28:03.80	-0.53
MOA	141.8	277	iPnC	0:28:03.90	-0.81
			iSn	28:22.10	-1.47
KMR	155.9	285	iPn	0:28:06.70	0.24
			iSn	28:25.40	-1.30
PKSC	176.2	101	iPnC	0:28:08.40	-0.60
OBKA	178.2	223	iPnD	0:28:09.70	0.45
			iSn	28:32.60	0.95
PKS9	203.1	127	iPnD	0:28:12.40	0.05
PKS8	211.8	115	iPnC	0:28:13.00	-0.43
			iSn	28:36.30	-2.81
BUD	218.0	96	iPnC	0:28:18.50	4.29
			iSn	28:45.00	4.51
KBA	221.8	252	iPnC	0:28:16.10	1.42
			iSn	28:44.00	2.67
KHC	248.6	310	Pn	0:28:19.00	0.97
			eSn	28:38.50	-8.79
PKSM	251.2	131	iPnC	0:28:17.80	-0.55
			iSn	28:44.30	-3.56
VOY	251.5	223	ePn	0:28:18.80	0.42
			eSn	28:57.70	9.78
CEY	253.1	211	iPnC	0:28:19.00	0.41
PKS2	268.4	120	iPnC	0:28:20.20	-0.29
			iSn	28:48.80	-2.87
PRU	281.6	335	ePn	0:28:22.80	0.65
			Sn	28:58.30	3.68
WET	290.9	304	iPnC	0:28:25.20	1.90
WTTA	342.8	262	iPnD	0:28:31.10	1.32
WATA	346.1	264	iPnD	0:28:31.40	1.22
KSP	351.3	2	ePn	0:28:39.50	8.67
			eSn	29:06.30	-3.77
SQTA	375.6	262	iPnC	0:28:35.20	1.34
MOTA	381.4	264	iPnC	0:28:35.40	0.82

BRG	388.8	336	ePn	0:28:45.00	9.49
			iSn	29:26.20	7.79
GRF	425.4	302	ePn	0:28:51.50	11.43
			eSn	29:41.40	14.88
GRF	425.4	302	ePn	0:28:42.40	2.33
CLL	462.7	331	ePn	0:28:59.00	14.28
			eSn	29:50.00	15.20
MOX	466.1	315	Pn	0:28:43.60	-1.55
TNS	630.1	297	ePn	0:29:06.50	0.90
			eSn	30:36.80	24.84



24.

1999-05-08 time: 0:54:20.48 UTC ML= 1.6
lat: 45.633N lon: 19.004E h= 1.9 km
erh= 4.2km erz= 140km
nr= 6 gap=310 rms=0.14
Locality: Yugoslavia
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	70.2	336	ePgC	0:54:33.10	0.08
			eSg	54:42.70	-0.11
PKS2	96.8	10	iPgD	0:54:37.60	-0.17
			iSg	54:51.20	-0.06
PKS6	115.8	22	iPgC	0:54:41.40	0.23
PKS9	119.9	332	iPgC	0:54:41.90	0.00

25.

1999-05-11 time: 20:40:07.70 UTC ML= 1.3
lat: 45.757N lon: 19.067E h= 8.4 km
erh=12.5km erz=88.2km
nr= 5 gap=305 rms=0.13
Locality: Yugoslavia
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	60.4	327	ePgC	20:40:18.60	0.02
			iSg	40:27.10	0.03
PKS2	82.5	8	iPgD	20:40:22.30	-0.20
PKS6	101.3	22	iPgD	20:40:26.00	0.16
			iSg	40:40.00	0.01

26.

1999-05-14 time: 11:02:00.33 UTC ML= 1.8
lat: 47.136N lon: 19.297E h= 10.4 km
erh= 0.6km erz= 0.4km
nr= 5 gap=179 rms=0.03
Locality: Kunpeszér
Comments:

sta	dist	azm	phase	hr mn sec	res
PKS7	14.3	226	iPgC	11:02:03.50	0.01
			eSg	02:06.20	0.25
PKSN	50.8	122	eSg	11:02:28.90	12.08
PKSC	70.6	293	ePg	11:02:13.10	0.04
			eSg	02:24.60	1.60
PSZ	97.9	27	iPgC	11:02:17.90	-0.01
			eSg	02:30.60	-1.03
PKS9	98.8	232	ePg	11:02:18.00	-0.06
PKSM	114.4	206	iPn	11:02:20.30	0.01
			eSn	02:34.60	-1.26

27.

1999-05-17 time: 10:35:04.90 UTC ML= 1.8
lat: 47.478N lon: 18.409E h= 10.0 km
erh= 6.2km erz= 1.0km
nr= 6 gap=343 rms=0.76
Locality: Vértes mt.
Comments: (explosion)

sta	dist	azm	phase	hr mn sec	res
PKSC	11.0	169	iPgC	10:35:07.20	-0.36
			eSg	35:08.00	-1.63
PKS9	99.5	186	iPgC	10:35:23.70	0.94
			eSg	35:36.30	-0.40
PKSM	141.9	173	iPnC	10:35:28.50	0.16
			eSn	35:45.00	-1.63

28.

1999-05-20 time: 18:23:30.04 UTC ML= 1.5
lat: 48.312N lon: 17.210E h= 4.1 km
erh= 6.8km erz= 4.2km
nr= 9 gap=185 rms=0.84
Locality: Slovakia
Comments:

sta	dist	azm	phase	hr mn sec	res
ZST	15.1	212	Pg	18:23:32.30	-0.53
			Sg	23:35.50	0.49
PKSC	138.4	138	iPnC	18:23:54.50	0.69
			eSn	24:11.20	-1.15
ARSA	172.9	227	iPn	18:23:58.40	0.29
			iSn	24:19.60	-0.41
MOA	225.3	257	iPnC	18:24:03.00	-1.65
			iSn	24:32.60	0.96
PRU	269.6	314	Sn	18:24:43.20	1.74
KHC	282.3	289	eSn	18:24:40.00	-4.30

29.

1999-05-22 time: 1:45:48.45 UTC ML= 1.6
lat: 45.694N lon: 19.168E h= 7.3 km
erh= 5.1km erz= 3.4km
nr= 9 gap=308 rms=0.52
Locality: Yugoslavia
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	70.6	325	iPgD	1:46:00.50	-0.62
			eSg	46:11.00	-0.01
PKS2	88.8	2	iPgC	1:46:03.80	-0.56

Hypocenter Parameters

			iSg	46:17.60	0.84
PKS6	105.3	17	iPgC	1:46:07.50	0.21
			iSg	46:21.80	-0.18
PKS9	120.7	325	iPnC	1:46:09.80	0.20
			eSn	46:35.10	9.00
PKS8	137.0	344	iPnC	1:46:12.20	0.57
			eSn	46:28.80	-0.91

30.

1999-05-22 time: 2:13:44.84 UTC ML= 1.9
lat: 45.661N lon: 19.169E h= 8.1 km
erh= 4.4km erz= 2.6km
nr= 10 gap=305 rms=0.52
Locality: Yugoslavia
Comments:

sta	dist	azm	phase	hr mn	sec	res
PKSM	73.7	326	iPgC	2:13:57.60		-0.47
			iSg	14:09.10		0.71
PKS2	92.4	2	iPgD	2:14:01.00		-0.41
			eSg	14:14.40		0.07
PKS6	108.7	16	iPgD	2:14:04.60		0.29
			eSg	14:18.70		-0.80
PKS9	123.8	326	ePnC	2:14:06.20		-0.08
PKS8	140.6	344	ePnC	2:14:08.70		0.33
			eSn	14:25.50		-1.22
PKSN	147.6	21	iSn	2:14:29.10		0.83

31.

1999-05-24 time: 1:02:42.90 UTC ML= 1.3
lat: 45.868N lon: 19.143E h= 7.2 km
erh=15.9km erz=80.7km
nr= 5 gap=310 rms=0.50
Locality: Yugoslavia
Comments:

sta	dist	azm	phase	hr mn	sec	res
PKSM	54.5	315	iPgC	1:02:52.90		0.19
			eSg	02:59.40		-0.96
PKS2	69.6	4	iPgD	1:02:54.80		-0.58
			eSg	03:05.60		0.47
PKS9	104.1	320	iPg	1:03:02.00		0.48

32.

1999-06-04 time: 2:09:45.12 UTC ML= 3.0
lat: 45.826N lon: 18.302E h= 10.0 km
erh=12.4km erz= 6.6km
nr= 11 gap=225 rms=0.85
Locality: Siklós
Comments: felt 4 EMS

sta	dist	azm	phase	hr mn	sec	res
PKSM	50.3	32	iPgD	2:09:53.90		-0.37
			eSg	09:59.80		-1.61
PKS9	84.6	359	iPgC	2:10:00.40		0.08
			eSg	10:12.90		0.71
PKS8	120.5	14	iPnD	2:10:05.30		-0.60
			iSn	10:21.00		-1.10
PKS6	130.0	49	iPnC	2:10:06.50		-0.58
			eSn	10:24.90		0.70
PKS7	150.9	26	iPnC	2:10:11.60		1.91
			iSn	10:29.60		0.74
PKSN	169.4	45	ePn	2:10:13.80		1.81
			iSn	10:36.20		3.25
BUD	192.3	17	eSn	2:10:41.30		3.25
DOBS	222.4	279	iPnC	2:10:18.20		-0.40
ARSA	265.5	307	iPnC	2:10:24.30		0.32
ZST	278.8	341	ePn	2:10:25.10		-0.53
			eSn	10:53.20		-4.04
OBKA	299.6	285	iPnC	2:10:27.30		-0.93
VOY	342.7	274	ePn	2:10:33.30		-0.30
			eSn	11:55.30		43.88
MOA	381.3	306	iPnD	2:10:39.50		1.08
KHC	511.6	316	ePn	2:10:55.50		0.83
			eSn	12:46.00		57.08

33.

1999-06-07 time: 14:00:03.40 UTC ML= 1.8
lat: 47.108N lon: 19.189E h= 10.0 km
erh= 3.7km erz= 2.1km
nr= 8 gap=109 rms=0.55
Locality: Apaj
Comments:

sta	dist	azm	phase	hr mn	sec	res
PKS7	7.1	197	iPgC	14:00:05.90		0.32
			eSg	00:06.50		-0.79
PKSN	56.7	114	iPg	14:00:13.90		0.22
PKSC	64.5	298	ePgC	14:00:15.40		0.35
PENC	76.2	5	ePgC	14:00:15.90		-1.22
PKS9	90.4	230	iPgC	14:00:20.20		0.56
PKSM	108.1	203	iPnC	14:00:21.90		-0.73
			iSn	00:37.70		0.07

34.

1999-06-09 time: 14:28:57.63 UTC ML= 1.3
lat: 47.458N lon: 16.490E h= 10.0 km
erh= 6.4km erz= 2.5km
nr= 8 gap=241 rms=0.97
Locality: Austria
Comments:

sta	dist	azm	phase	hr mn	sec	res
SOP	25.6	11	iPgD	14:29:02.60		0.07
			iSg	29:05.70		-0.66
ARSA	76.6	253	iPg	14:29:11.50		0.07
			iSg	29:20.90		-1.29
MOA	172.7	285	iPnD	14:29:27.10		2.18
			iSn	29:46.90		0.70
KHC	285.2	311	ePn	14:29:36.00		-2.94
			eSn	30:14.50		3.34

35.

1999-06-16 time: 4:50:45.79 UTC ML= 2.0
lat: 46.055N lon: 16.842E h= 10.0 km
erh= 5.9km erz= 4.6km
nr= 22 gap=161 rms=1.43
Locality: Croatia
Comments:

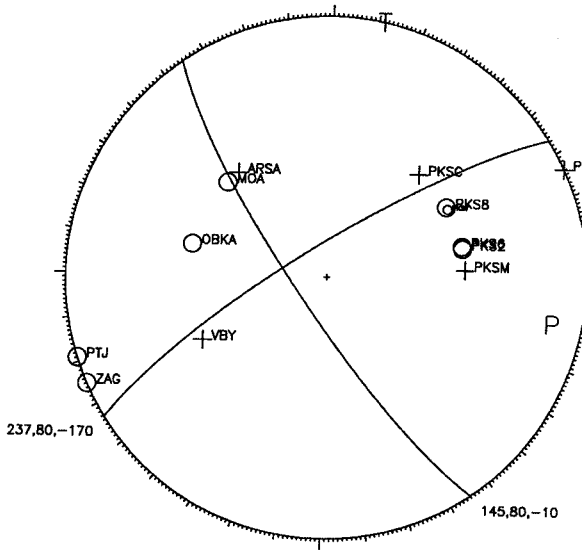
sta	dist	azm	phase	hr mn	sec	res
PTJ	69.2	256	iPgD	4:50:58.20		-0.09
			iSg	51:07.10		-0.93
DOBS	106.7	276	iP*	4:51:03.96		-0.87
			iS*	51:18.62		-1.06
CESS	107.1	265	iP*	4:51:04.85		-0.05
			iS*	51:18.66		-1.15
PKS9	125.5	62	ePn	4:51:07.10		-0.10
			eSn	51:24.10		0.20
VBY	137.6	244	iPn	4:51:10.35		1.64
			iSn	51:27.79		1.21
PKSM	140.2	83	iPnC	4:51:07.60		-1.43
			iSn	51:27.20		0.05
ARSA	166.9	323	iPnD	4:51:14.70		2.34
			iSn	51:33.60		0.51
PKS8	168.1	57	iPnD	4:51:10.40		-2.11
			iSn	51:33.50		0.15
CEY	190.7	259	eSn	4:51:43.80		5.44

PKS7	209.3 58	eSn	4:51:46.20	3.70
VOY	228.2 269	ePn	4:51:24.30	4.29
		eSn	51:53.80	7.10
MOA	279.8 316	iPnD	4:51:28.20	1.77
		iSn	51:56.30	-1.83

36.

1999-06-17 time: 5:22:21.26 UTC ML= 3.1
lat: 46.139N lon: 16.936E h= 0.7 km
erh= 9.4km erz= 7.0km
nr= 20 gap=155 rms=1.55
Locality: Croatia
Comments:

sta	dist	azm	phase	hr mn sec	res
PTJ	78.9	251	iPgD	5:22:34.40	-0.94
			iSg	22:43.50	-2.82
ZAG	80.8	245	iPgD	5:22:34.80	-0.88
			iSg	22:44.50	-2.43
PKS9	114.7	64	iPgC	5:22:41.70	-0.04
			Sg	22:59.10	1.39
CESS	115.5	261	iPg	5:22:40.50	-1.38
			iSg	22:54.70	-3.27
PKSM	131.9	86	iPnC	5:22:43.70	-0.95
			iSn	23:03.40	0.50
VBY	148.4	242	iPnC	5:22:45.90	-0.81
			iSn	23:03.90	-2.66
BISS	150.2	292	iPn	5:22:45.70	-1.24
			eSn	23:03.20	-3.76
PKS8	156.8	58	iPnD	5:22:46.40	-1.36
			iSn	23:09.20	0.77
ARSA	164.2	319	iPnC	5:22:48.10	-0.58
			iSn	23:10.40	0.34
PKSC	179.4	40	iPnC	5:22:50.00	-0.58
PKS2	179.7	77	iPnD	5:22:49.80	-0.81
			iSn	23:11.40	-2.11
LJU	186.6	267	iPn	5:22:53.60	2.13
			iSn	23:15.00	-0.04
OBKA	188.4	283	iPnD	5:22:53.40	1.70
			iSn	23:17.30	1.86
PKS7	198.1	59	ePnD	5:22:56.60	3.69
CEY	199.7	257	iPn	5:22:54.40	1.30
			iSn	23:18.20	0.26
PKS6	208.6	76	iPnD	5:22:58.90	4.68
ZST	229.0	3	ePn	5:22:56.20	-0.56
			eSn	23:20.10	-4.36
VOY	235.7	267	ePn	5:22:56.60	-0.99
			eSn	23:29.40	3.47
PKSN	240.2	69	eSn	5:23:36.60	9.67
MOA	278.2	313	iPnD	5:23:03.30	0.40
			iSn	23:33.10	-2.28
KBA	294.3	291	iPn	5:23:06.50	1.60
			iSn	23:47.90	8.95
BEO	311.7	118	iPn	5:23:31.70	24.63
KHC	417.6	323	ePn	5:23:20.50	0.23
			eSn	24:03.50	-2.80
WTTA	424.2	287	iPn	5:23:24.10	3.00
PRU	463.7	337	ePn	5:23:28.60	2.57
			Sn	24:35.90	19.35



37.

1999-06-20 time: 7:46:28.59 UTC ML= 1.8
lat: 45.857N lon: 18.111E h= 8.3 km
erh= 6.5km erz= 3.0km
nr= 8 gap=319 rms=0.62
Locality: Rádfalva
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	56.9	46	iPgD	7:46:38.60	-0.26
			iSg	46:46.40	-0.48
PKS9	82.2	9	ePgC	7:46:43.90	0.56
			iSg	46:55.20	0.35
PKS2	110.6	50	ePn	7:46:49.10	0.75
			iSn	47:04.70	0.94
PKS8	121.6	21	iPn	7:46:48.80	-0.93
			Sn	47:06.00	-0.22

38.

1999-06-20 time: 8:13:35.77 UTC ML= 1.6
lat: 45.843N lon: 18.211E h= 10.0 km
erh= 4.9km erz= 2.6km
nr= 5 gap=324 rms=0.23
Locality: Harkány
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	52.8	39	iPgD	8:13:45.20	-0.17
			iSg	13:53.00	0.14
PKS9	82.8	4	iPgC	8:13:51.00	0.33
			iSg	14:02.00	-0.29
PKS8	120.5	17	eSn	8:14:12.70	-0.07

39.

1999-06-20 time: 14:28:31.25 UTC ML= 1.8
lat: 47.405N lon: 18.507E h= 5.8 km
erh= 3.1km erz= 2.9km
nr= 12 gap=171 rms=0.53
Locality: Csákvár
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSC	5.9	243	iPgC	14:28:32.60	-0.12
			iSg	28:33.50	-0.37

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PKS8	59.9	168	ePgC	14:28:42.00	0.01
			iSg	28:49.80	-0.57
PENC	72.4	54	ePgC	14:28:44.30	0.09
PKS9	92.5	191	ePgC	14:28:48.50	0.70
			iSg	29:01.10	0.39
PKS2	114.8	152	iPg	14:28:52.50	0.72
			eSg	29:07.10	-0.69
PSZ	118.9	61	iPnC	14:28:52.70	0.34
			eSn	29:07.70	-1.13
PKSM	133.0	176	ePn	14:28:53.10	-1.02
			eSn	29:08.60	-3.36

40.

1999-06-24 time: 9:55:07.80 UTC ML= 1.4
lat: 47.477N lon: 18.518E h= 10.0 km
erh= ---km erz= ---km
nr= 4 gap=327 rms=0.80
Locality: Vértes mt.
Comments: (explosion)

sta	dist	azm	phase	hr mn sec	res
PKSC	12.4	210	iPgC	9:55:10.50	-0.14
			iSg	55:12.20	-0.66
PKS9	100.6	190	iPgC	9:55:27.00	1.14
PKSM	141.0	176	eSn	9:55:48.30	-1.04

41.

1999-06-28 time: 20:20:26.47 UTC ML= 2.0
lat: 46.743N lon: 21.307E h= 10.0 km
erh=17.3km erz= 9.2km
nr= 12 gap=253 rms=0.93
Locality: Tarhos
Comments:

sta	dist	azm	phase	hr mn sec	res
GYL	19.3	213	iPgC	20:20:30.95	0.60
			iSg	20:33.00	-0.37
PKS6	134.3	263	iPnD	20:20:47.80	-1.17
			iSn	21:03.70	-2.82
PKS2	162.8	260	iPnD	20:20:52.40	-0.12
			eSn	21:12.00	-0.84
PKS7	167.0	282	iSn	20:21:13.90	0.12
PSZ	168.8	321	iPn	20:20:54.00	0.73
			iSn	21:08.60	-5.58
PKS8	201.3	274	iSn	20:21:21.50	0.10
PKSM	213.0	254	ePnC	20:20:59.70	0.91
			iSn	21:24.70	0.70
PKS9	232.4	266	eSn	20:21:31.50	3.21

42.

1999-06-29 time: 2:00:29.79 UTC ML= 1.9
lat: 46.804N lon: 21.240E h= 6.7 km
erh=36.5km erz=28.7km
nr= 16 gap=233 rms=1.33
Locality: Sarkad
Comments:

sta	dist	azm	phase	hr mn sec	res
GYL	23.5	193	iPgC	2:00:34.60	0.44
			iSg	00:36.70	-0.87
PKS6	130.1	260	iPnC	2:00:51.40	-0.80
			eSn	01:07.30	-2.37
PKS2	159.0	257	iPnC	2:00:55.60	-0.19
			iSn	01:15.70	-0.38
PSZ	160.3	321	ePnD	2:00:57.40	1.44
			iSn	01:14.30	-2.06
PKS7	160.7	280	eSn	2:01:16.50	0.05
PKS8	195.7	272	ePnD	2:01:05.90	5.52
			eSn	01:25.60	1.37
PKSM	210.0	252	ePnD	2:01:03.40	1.24
			eSn	01:28.40	1.00
PKSC	222.3	287	eSn	2:01:36.00	5.88
PKS9	227.8	264	iPnC	2:01:08.40	4.03
			eSn	01:34.40	3.06

43.

1999-07-17 time: 0:40:35.26 UTC ML= 1.9
lat: 45.959N lon: 17.790E h= 10.0 km
erh= 5.7km erz= 2.2km
nr= 12 gap=311 rms=0.62
Locality: Szentegát
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	71.6	67	iPgC	0:40:48.50	0.32
			eSg	40:57.80	-0.45
PKS9	79.3	28	iPgC	0:40:49.60	0.06
			eSg	41:00.80	0.12
PKS8	122.9	34	iPnC	0:40:55.80	-0.54
			eSn	41:10.00	-2.78
PKS2	124.8	62	iPnC	0:40:56.80	0.22
			iSn	41:12.80	-0.40
PKS6	154.2	62	iPnC	0:40:55.80	-4.45
PKS7	160.4	41	ePnC	0:41:00.80	-0.21
			eSn	41:23.30	2.20
PKSC	165.6	17	ePnC	0:41:01.40	-0.27
			iSn	41:23.20	0.93

44.

1999-07-26 time: 5:50:33.71 UTC ML= 3.1
lat: 47.821N lon: 16.483E h= 10.0 km
erh= 6.6km erz= 4.1km
nr= 10 gap=177 rms=0.96
Locality: Austria
Comments:

sta	dist	azm	phase	hr mn sec	res
VKA	50.9	346	iPgC	5:50:42.30	-0.67
			iSg	50:48.60	-1.59
ZST	62.3	48	ePg	5:50:45.90	0.93
			eSg	50:54.10	0.34
ARSA	96.1	229	iPgC	5:50:50.00	-0.96
			iSg	51:01.60	-2.83
VRAC	165.7	3	Pn	5:50:59.50	-0.62
			Sn	51:18.20	-2.53
MOA	166.0	271	iPnD	5:50:59.70	-0.46
			iSn	51:18.10	-2.69
OBKA	206.8	225	iPnC	5:51:06.80	1.55
			iSn	51:34.80	4.95
MORC	231.0	20	Pn	5:51:08.60	0.33
			Sn	51:34.30	-0.93
KBA	250.7	251	iPnC	5:51:11.80	1.09
KHC	259.5	304	ePn	5:51:13.00	1.18
			eSn	51:38.00	-3.55
PRU	279.9	329	Pn	5:51:17.10	2.74

45.

1999-08-03 time: 6:51:38.00 UTC ML= 2.8
lat: 48.062N lon: 21.336E h= 15.0 km
erh= ---km erz= ---km
nr= 4 gap=318 rms=0.59
Locality: Taktabáj
Comments: felt 5 EMS

sta	dist	azm	phase	hr mn sec	res
PSZ	108.7	262	iPn	6:51:56.75	0.07
			eSn	52:11.15	-0.09
PKS7	198.8	235	iSn	6:52:36.21	4.98

```
PKS6 210.6 219    eSn     6:52:32.93    -0.91
```

46.

```
1999-08-16  time:  0:17:02.17 UTC  ML= 2.3
   lat: 46.768N  lon: 20.879E  h= 11.9 km
                 erh= 5.6km    erz= 2.2km
   nr= 11        gap=287       rms=0.56
   Locality: Kondoros
   Comments:

sta   dist azm  phase  hr mn  sec     res
PKSN   78.5 281   iPgD   0:17:15.90   -0.45
                  iSg      17:27.70    0.29
PKS6  102.3 259   iP*C   0:17:20.90    0.54
                  eS*      17:34.00   -0.55
PKS2  131.2 256   ePn    0:17:24.10    0.06
                  eSn      17:40.90   -0.20
PKS7  134.5 283   ePn    0:17:25.30    0.84
                  iSn      17:41.00   -0.84
PSZ   148.0 330   ePnC   0:17:25.90   -0.23
                  eSn      17:41.90   -2.92
PKS8  168.5 274   eSn    0:17:50.20    0.82
```

47.

```
1999-08-19  time: 22:22:49.47 UTC  ML= 2.3
   lat: 45.824N  lon: 17.867E  h= 13.3 km
                 erh= 9.8km    erz= 7.8km
   nr=  7        gap=324       rms=0.32
   Locality: Sósvertike
   Comments:

sta   dist azm  phase  hr mn  sec     res
PKS9   90.6  21   iP*C  22:23:06.10    0.35
                  eS*      23:18.00   -0.45
PKS2  127.8  54   iPnC  22:23:10.40   -0.35
                  iSn      23:27.00   -0.34
PKS8  132.7  28   iPnD  22:23:11.30   -0.07
                  iSn      23:28.70    0.26
PKS6  156.8  57   eSn    22:23:34.30    0.51
```

48.

```
1999-08-22  time: 12:03:35.37 UTC  ML= 2.0
   lat: 47.847N  lon: 18.132E  h=  7.9 km
                 erh= 1.3km    erz= 1.4km
   nr= 10        gap=150       rms=0.29
   Locality: Slovakia
   Comments:

sta   dist azm  phase  hr mn  sec     res
PKSC   56.7 156   ePgD  12:03:46.00    0.40
                  iSg      03:53.50   -0.07
ZST    86.1 297   ePg    12:03:50.80   -0.01
                  eSg      04:00.90   -1.95
PENC   86.3  94   iPgD  12:03:51.00    0.15
                  iSg      04:02.60   -0.32
PSZ   132.0  87   ePn    12:03:58.30    0.44
                  eSn      04:15.50    0.10
PKSM  185.9 168   iPnD  12:04:04.40   -0.17
                  eSn      04:26.50   -0.85
```

49.

```
1999-09-03  time:  9:38:19.09 UTC  ML= 3.4
   lat: 46.590N  lon: 21.121E  h= 18.2 km
                 erh= 8.6km    erz= 2.9km
   nr= 13        gap=135       rms=0.62
   Locality: Békés
   Comments: Felt 3 EMS

sta   dist azm  phase  hr mn  sec     res
GYL    3.7   77   iPgC   9:38:22.30   -0.11
                  iSg      38:24.50   -0.49
BZS  114.7 161   iPnD   9:38:37.50   -0.61
                  eSn      38:50.00   -2.94
PKS6 119.3 271   iPnC   9:38:38.60   -0.08
                  iSn      38:54.60    0.64
PKS2 146.8 266   ePn    9:38:43.90    1.80
PKS7 158.0 289   iPnD   9:38:43.40   -0.11
GZR  184.8 136   iPnD   9:38:47.40    0.56
                  eSn      39:05.60   -2.89
BUD  187.8 302   ePn    9:38:47.00   -0.22
                  eSn      39:14.00    4.83
PKS8 189.6 280    Pn    9:38:51.90    4.46
                  iSn      39:14.80    5.24
PKSM 195.3 258   ePnC   9:38:47.20   -0.95
                  iSn      39:10.90    0.08
PKS9 217.8 270   ePn    9:38:50.40   -0.57
PKSC 222.3 293   iPnD   9:38:51.90    0.38
ZST  352.1 300   ePn    9:39:07.90    0.20
                  eSn      39:42.70   -2.92
SOP  366.9 289   iPnD   9:39:09.80    0.25
ARSA 432.7 280   iPnD   9:39:17.90    0.14
                  iSn      39:52.00  -11.51
MOA  537.8 285   iPnD   9:39:32.60    1.74
                  iSn      40:25.40   -1.44
KHC  631.2 297   ePn    9:39:43.00    0.49
                  eSn      40:30.50  -17.07
```

50.

```
1999-09-06  time:  9:53:30.52 UTC  ML= 1.7
   lat: 47.478N  lon: 18.494E  h=  6.4 km
                 erh=26.7km    erz= 9.3km
   nr=  6        gap=334       rms=0.59
   Locality: Vértes mt.
   Comments: (explosion)

sta   dist azm  phase  hr mn  sec     res
PKSC   11.6 202   iPgC   9:53:32.80   -0.09
                  iSg      53:34.10   -0.64
PKS9  100.4 189   iPgC   9:53:49.30    0.82
                  eSg      54:02.30   -0.19
PKSM  141.2 175   ePnC   9:53:54.00   -0.34
                  eSn      54:08.90   -4.01
KHC   408.4 297   ePn    9:54:34.00    6.35
```

51.

```
1999-09-07  time: 20:30:00.01 UTC  ML= 1.4
   lat: 46.809N  lon: 17.954E  h=  0.0 km
                 erh= 3.3km    erz= 495km
   nr=  7        gap=249       rms=0.33
   Locality: Bálványos
   Comments: (explosion)

sta   dist azm  phase  hr mn  sec     res
PKS9   35.0 135   iPgC  20:30:06.70    0.44
                  iSg      30:11.00   -0.14
PKS8   55.7  82   ePgC  20:30:09.90   -0.06
                   Sg      30:17.70   -0.02
PKSC   73.4  30   ePg    20:30:13.10   -0.02
PKSM   84.8 141   ePgC   20:30:14.10   -1.05
```

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```
PKS7  95.7  74   iPgC  20:30:17.10    0.00
```

52.

```
1999-09-08  time:  1:06:11.99 UTC  ML= 2.4
   lat: 45.945N  lon: 16.120E  h= 10.0 km
                 erh= 5.2km    erz= 3.9km
   nr= 10        gap=262       rms=0.51
   Locality: Croatia
   Comments:

sta   dist azm  phase  hr mn  sec     res
PTJ   12.1 250   iPgC   1:06:14.80    0.01
                 iSg      06:17.00    0.02
ZAG   16.2 217   iPg    1:06:15.20   -0.19
                 iSg      06:17.80   -0.25
CESS  51.0 273   iPg    1:06:21.88    0.61
                 iSg      06:28.69    0.18
DOBS  55.2 294   iPg    1:06:22.55    0.54
                 iSg      06:29.38   -0.45
BISS 109.3 316   iPn    1:06:31.57    0.20
                 iSn      06:44.28   -2.21
```

53.

```
1999-09-09  time:  6:15:58.71 UTC  ML= 1.9
   lat: 45.819N  lon: 18.173E  h=  2.8 km
                 erh= 0.9km    erz= 0.9km
   nr=  5        gap=314       rms=0.04
   Locality: Drávacsehi
   Comments:

sta   dist azm  phase  hr mn  sec     res
PKSM  56.8  40   iPgD   6:16:08.90    0.04
                 eSg      16:16.70   -0.08
PKS9  85.7   5   iPgD   6:16:14.00   -0.03
                 iSg      16:26.00    0.02
PKS6 138.1  51   ePn    6:16:22.60   -0.01
                 eSn      16:42.60    1.35
```

54.

```
1999-09-09  time: 20:29:56.64 UTC  ML= 1.4
   lat: 46.406N  lon: 16.619E  h=  0.0 km
                 erh= ---km    erz= ---km
   nr=  4        gap=314       rms=0.28
   Locality: Oltárc
   Comments: (explosion)

sta   dist azm  phase  hr mn  sec     res
PKS9 129.0  81   iPgC  20:30:19.80    0.13
PKSM 157.3  98   e nC  20:30:23.10   -0.18
PKS8 166.1  72   ePnC  20:30:23.70   -0.68
PKSC 175.9  52   ePnC  20:30:25.80    0.20
```

55.

```
1999-09-09  time: 20:45:00.48 UTC  ML= 1.4
   lat: 47.606N  lon: 16.939E  h=  0.0 km
                 erh= 8.2km    erz=10.7km
   nr=  7        gap=147       rms=0.73
   Locality: Fertőd
   Comments: (explosion)

sta   dist azm  phase  hr mn  sec     res
SOP   29.9 287   iPgC  20:45:05.80   -0.01
                 eSg      45:08.90   -1.07
ZST   66.8  11   ePg   20:45:12.80    0.39
PKSC 115.6 102   ePgC  20:45:21.30    0.17
PKS9 152.2 138   iPnC  20:45:27.90    1.40
PKS8 154.4 122   iPnC  20:45:26.50   -0.27
PKSM 202.1 140   ePnC  20:45:31.40   -1.31
```

56.

```
1999-09-09  time: 20:59:59.78 UTC  ML= 1.7
   lat: 46.106N  lon: 18.695E  h= 10.1 km
                 erh= 2.7km    erz= 1.1km
   nr= 13        gap=278       rms=0.34
   Locality: Dunaszekcső
   Comments: (explosion)

sta   dist azm  phase  hr mn  sec     res
PKSM  12.5 340   iPgC  21:00:02.40   -0.24
                 eSg      00:04.30   -0.58
PKS2  58.6  43   iPgC  21:00:10.80    0.41
                 eSg      00:18.60   -0.08
PKS9  62.3 329   ePgC  21:00:11.40    0.35
                 eSg      00:20.20    0.35
PKS8  85.9 359   ePgC  21:00:15.10   -0.12
                 eSg      00:28.00    0.73
PKS6  86.5  51   iPgC  21:00:15.10   -0.24
                 eSg      00:25.50   -1.97
PKS7 110.6  19   iPnC  21:00:19.40    0.09
                 eSn      00:34.40   -0.14
PKSC 143.1 352   ePnC  21:00:23.20   -0.16
                 eSn      00:40.60   -1.15
```

57.

```
1999-09-10  time: 15:54:09.69 UTC  ML= 2.4
   lat: 46.219N  lon: 16.014E  h=  1.4 km
                 erh= 2.2km    erz= 2.4km
   nr= 20        gap=203       rms=0.65
   Locality: Croatia
   Comments:

sta   dist azm  phase  hr mn  sec     res
PTJ   34.6 185   iPgD  15:54:16.00    0.12
                 iSg      54:19.90   -0.81
DOBS  42.8 260   iPg   15:54:17.16   -0.17
                 iSg      54:23.74    0.44
CESS  50.6 237   iPg   15:54:19.40    0.67
                 iSg      54:25.76   -0.03
BISS  83.2 305   iPg   15:54:23.88   -0.66
VBY   98.9 217   iPg   15:54:27.99    0.65
                 iSg      54:41.68    0.56
LJU  116.6 260   ePg   15:54:29.60   -0.90
                 eSg      54:46.00   -0.74
OBKA 117.3 286   iPg   15:54:30.20   -0.43
                 iSg      54:46.80   -0.17
ARSA 120.6 342   iPgC  15:54:31.50    0.27
                 iSg      54:48.20    0.17
CEY  134.1 247   iPn   15:54:33.15   -0.11
                 iSn      54:50.77   -0.88
VOY  165.3 263   ePn   15:54:37.10   -0.05
                 eSn      55:00.20    1.64
KBA  225.6 295   iPnD  15:54:49.10    4.43
                 iSn      55:18.10    6.15
KHC  371.8 331   ePn   15:55:03.50    0.60
                 eSn      55:35.00   -9.41
```

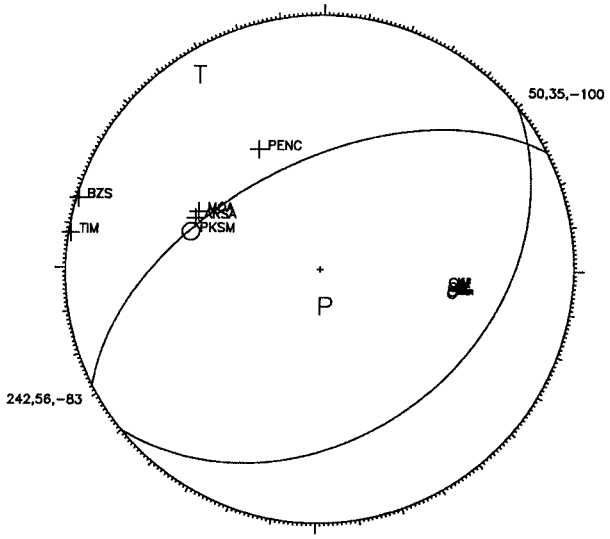
58.

```
1999-10-03  time:  4:43:40.16 UTC  ML= 3.0
   lat: 45.772N  lon: 20.860E  h=  0.6 km
                 erh= 6.2km    erz= 5.3km
   nr= 12        gap=180       rms=0.94
   Locality: Romania
   Comments:

sta   dist azm  phase  hr mn  sec     res
TIM   28.4  98   iPgC   4:43:45.00   -0.24
                 iSg      43:47.05   -2.15
```

Hypocenter Parameters

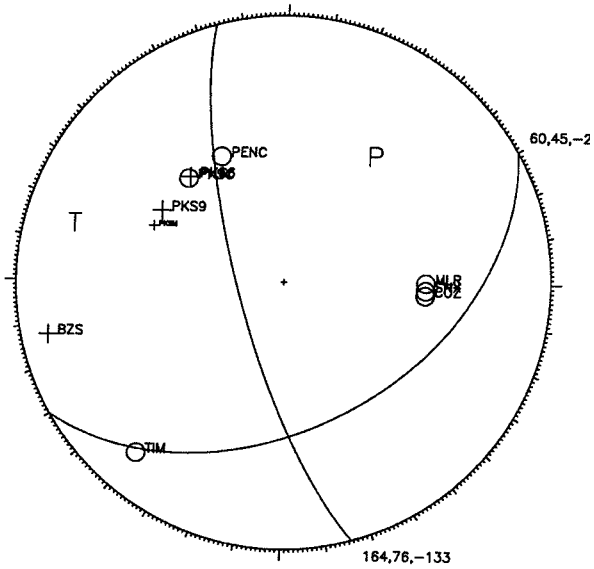
BZS	61.4	106	iPgC	4:43:50.00	-1.12
			iSg	43:57.04	-2.63
PKSM	178.7	286	iPnD	4:44:09.80	0.40
			eSn	44:36.50	4.29
BUD	236.6	324	ePn	4:44:17.00	0.38
			iSn	44:41.60	-3.46
PENC	254.7	332	iPnC	4:44:18.40	-0.48
COZ	276.6	100	ePnD	4:44:24.00	2.40
			eSn	44:52.93	-1.00
SRO	298.8	319	ePn	4:44:25.10	0.72
			eSn	44:56.80	-2.07
MTUR	334.1	100	ePnD	4:44:31.30	2.53
SNX	366.2	97	ePnD	4:44:34.60	1.82
ZST	392.9	313	ePn	4:44:36.60	0.49
			eSn	45:15.80	-3.94
MLR	397.6	95	ePnD	4:44:38.60	1.91
ARSA	441.3	292	iPnC	4:44:42.90	0.75
			iSn	45:28.20	-2.30
ISR	450.2	99	ePnD	4:44:46.00	2.74
VRAC	507.7	321	Pn	4:44:49.90	-0.52
			Sn	45:40.20	-5.02
MORC	510.0	331	Pn	4:44:50.10	-0.61
			Sn	45:40.40	-5.34
MOA	553.8	295	iPnC	4:44:57.80	1.63
			iSn	45:55.70	0.25
KHC	664.1	304	ePn	4:45:11.50	1.57



59.

1999-10-08 time: 17:26:14.28 UTC ML= 2.9
lat: 45.512N lon: 20.957E h= 10.0 km
erh=24.4km erz=16.2km
nr= 14 gap=199 rms=1.88
Locality: Romania
Comments:

sta	dist	azm	phase	hr mn sec	res
TIM	32.4	40	iPgD	17:26:20.80	0.47
			eSg	26:27.50	2.45
BZS	52.7	77	iPgC	17:26:21.10	-2.76
			eSg	26:28.60	-2.74
PKS6	162.0	318	iPnC	17:26:40.70	0.47
PKS2	173.5	309	ePn	17:26:44.80	3.12
PKSM	196.0	293	ePnC	17:26:43.30	-1.17
			eSn	27:08.80	0.78
PKS7	219.8	321	ePn	17:26:47.80	0.36
PKS8	232.5	311	ePn	17:26:46.20	-2.83
			iSn	27:24.60	8.46
PKS9	239.3	300	iPnC	17:26:49.20	-0.67
COZ	265.8	95	iPnD	17:26:51.70	-1.48
PENC	283.9	333	iPnD	17:26:55.50	0.06
PKSC	284.0	317	iPnD	17:26:55.80	0.35
			eSn	27:40.10	12.54
SNX	356.9	93	iPnD	17:27:08.80	4.26
MLR	389.7	90	iPnD	17:27:11.70	3.07
ARSA	460.6	295	iPn	17:27:20.70	3.24
			iSn	28:05.30	-1.45
KHC	687.8	306	ePn	17:27:47.00	1.20



60.

1999-10-09 time: 10:51:33.98 UTC ML= 2.0
lat: 46.035N lon: 18.001E h= 0.4 km
erh= 4.6km erz= 2.8km
nr= 7 gap=311 rms=0.39
Locality: Szabadszentkirály
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	53.2	68	iPgD	10:51:43.30	-0.19
			iSg	51:51.10	0.20
PKS9	65.0	19	ePgC	10:51:48.60	3.02
PKS8	107.2	29	iPgC	10:51:53.50	0.38
			iSg	52:07.70	-0.35
PKS6	135.8	62	ePnD	10:51:57.10	-0.79
			iSn	52:16.90	0.35

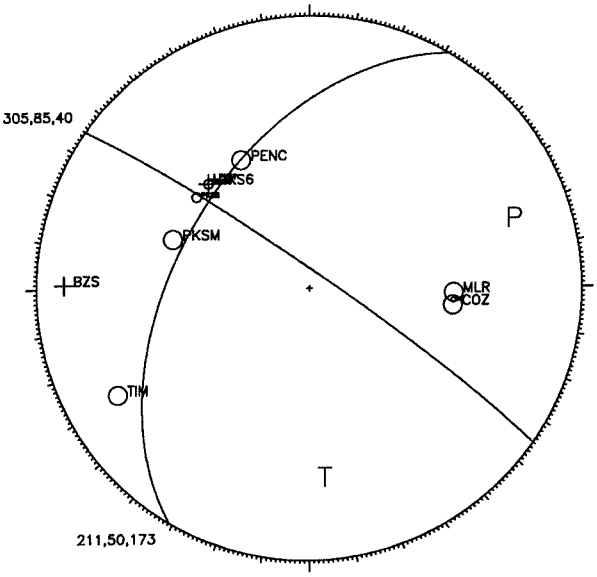
61.

1999-10-09 time: 20:49:17.06 UTC ML= 2.7
lat: 45.623N lon: 20.924E h= 10.0 km
erh=18.5km erz=10.8km
nr= 10 gap=193 rms=1.96
Locality: Yugoslavia
Comments:

sta	dist	azm	phase	hr mn sec	res
TIM	26.4	61	iPgD	20:49:22.60	0.49
			eSg	49:29.00	2.96
BZS	53.9	91	iPgC	20:49:22.90	-3.96
			eSg	49:28.00	-6.50
PKS6	151.2	316	iPnC	20:49:42.30	0.63
PKSM	188.8	290	iPnD	20:49:45.30	-1.06
			iSn	50:07.60	-1.62
PKS7	208.6	319	ePnC	20:49:49.40	0.57
			iSn	50:22.90	9.29

Hypocenter Parameters

PKS8	222.6	309	ePnD	20:49:50.50	-0.07
			iSn	50:26.10	9.39
PKS9	230.9	298	iSn	20:50:29.20	10.64
COZ	269.4	97	iPnD	20:49:59.00	2.59
PENC	271.8	332	iPnD	20:49:57.30	0.59
PKSC	273.2	316	ePnD	20:49:56.90	0.01
			eSn	50:43.20	15.25
SNX	360.0	95	iPnD	20:50:17.60	9.90
MLR	392.1	92	iPnD	20:50:15.20	3.49



62.

1999-10-11 time: 2:56:29.19 UTC ML=
lat: 46.263N lon: 18.930E h= 10.0 km
erh= ---km erz= ---km
nr= 4 gap=271 rms=0.57
Locality: Érsekcsanád
Comments:

sta	dist	azm	phase	hr mn	sec	res
PKSM	23.0	256	ePgC	2:56:33.90		0.24
PKS9	61.6	306	iPgC	2:56:40.10		-0.24
PKS8	71.1	344	ePgC	2:56:43.30		1.28
PKSC	129.8	343	iPnD	2:56:50.70		-0.43

63.

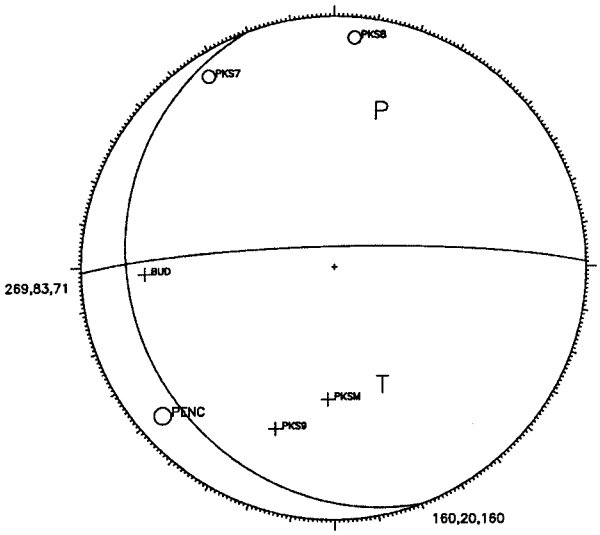
1999-10-11 time: 11:45:13.11 UTC ML= 1.7
lat: 46.155N lon: 19.190E h= 10.0 km
erh= 8.5km erz= 4.9km
nr= 6 gap=301 rms=0.50
Locality: Bácsbokod
Comments:

sta	dist	azm	phase	hr mn	sec	res
PKSM	42.8	279	iPgC	11:45:21.60		0.64
			iSg	45:26.70		-0.38
PKS9	85.0	304	iPgC	11:45:28.10		-0.29
PKS8	89.6	334	ePgD	11:45:29.10		-0.11
			eSg	45:43.10		1.34
PKSC	147.9	337	eSn	11:45:55.70		-0.48

64.

1999-10-13 time: 18:50:08.52 UTC ML= 1.8
lat: 47.476N lon: 18.750E h= 10.0 km
erh= 3.5km erz= 2.7km
nr= 13 gap=209 rms=0.66
Locality: Etyek
Comments:

sta	dist	azm	phase	hr mn	sec	res
BUD	20.7	88	iPgU	18:50:12.54		-0.08
			iSg	50:14.72		-1.09
PENC	53.1	49	iPgD	18:50:18.17		0.01
			iSg	50:26.84		1.15
PKS7	56.9	147	iPgD	18:50:19.83		0.99
			iSg	50:26.71		-0.18
PKS8	66.7	185	iPgD	18:50:21.00		0.45
			iSg	50:29.22		-0.72
PKS9	105.1	200	iP*U	18:50:27.66		0.34
			eS*	50:41.70		-0.29
PKS2	114.9	162	iSn	18:50:44.11		-0.16
PKSM	140.8	183	iPn+	18:50:31.45		-0.38
			eSn	50:47.04		-2.97



65.

1999-10-13 time: 18:50:17.90 UTC ML= 0.9
lat: 47.425N lon: 18.920E h= 0.1 km
erh= ---km erz= ---km
nr= 4 gap=213 rms=0.56
Locality: Törökbálint
Comments:

sta	dist	azm	phase	hr mn	sec	res
BUD	10.2	50	ePgN	18:50:19.05		-0.67
			eSg	50:21.22		0.08
PKS8	63.5	197	iPgN	18:50:29.97		0.74
			eSg	50:37.65		-0.42

Hypocenter Parameters

66.

1999-10-13 time: 18:50:28.22 UTC ML= 1.4
lat: 47.426N lon: 18.825E h= 3.9 km
erh=15.1km erz=10.0km
nr= 8 gap=236 rms=1.35
Locality: Sóskút
Comments:

sta	dist	azm	phase	hr mn sec	res
BUD	16.3	67	iPgU	18:50:30.90	-0.32
			iSg	50:33.09	-0.47
PKS8	61.8	190	ePgN	18:50:37.94	-1.35
			iSg	50:47.47	-0.45
PKS2	107.9	164	iPgN	18:50:50.85	3.34
			iSg	51:02.33	-0.22
PKSM	135.7	186	iPnN	18:50:54.06	2.38
			eSn	51:08.10	-1.87

67.

1999-10-13 time: 18:50:45.28 UTC ML= 0.5
lat: 47.493N lon: 18.830E h= 10.0 km
erh= ---km erz= ---km
nr= 3 gap=264 rms=0.19
Locality: Biatorbágy
Comments:

sta	dist	azm	phase	hr mn sec	res
BUD	14.6	94	iPgU	18:50:48.58	0.14
			iSg	50:50.57	-0.34
PKS8	69.3	190	eSg	18:51:07.54	0.01

68.

1999-10-13 time: 18:53:29.57 UTC ML= 1.3
lat: 47.425N lon: 18.852E h= 7.8 km
erh= 4.3km erz= 3.5km
nr= 9 gap=206 rms=0.47
Locality: Sóskút
Comments:

sta	dist	azm	phase	hr mn sec	res
BUD	14.5	63	iPgU	18:53:32.54	0.03
			eSg	53:34.49	-0.31
PENC	51.9	39	iPgD	18:53:38.12	-0.82
			iSg	53:46.95	0.70
PKS8	62.2	192	iPgD	18:53:40.97	0.20
			eSg	53:49.57	0.06
PKS2	107.4	165	ePgN	18:53:49.61	0.82
			iSg	54:04.06	0.27
PKSM	135.9	187	iSn	18:54:10.09	-0.38

69.

1999-10-13 time: 20:23:01.19 UTC ML= 0.9
lat: 47.377N lon: 18.987E h= 0.2 km
erh= ---km erz= ---km
nr= 4 gap=190 rms=0.53
Locality: Halásztelek
Comments:

sta	dist	azm	phase	hr mn sec	res
BUD	12.1	13	iPgC	20:23:03.00	-0.36
			iSg	23:05.20	0.15
PKS8	60.2	203	iPgD	20:23:12.70	0.75
			iSg	23:19.70	-0.64

70.

1999-10-13 time: 20:23:19.11 UTC ML= 1.0
lat: 47.374N lon: 19.045E h= 7.7 km
erh= 9.0km erz= 2.7km
nr= 5 gap=201 rms=0.13
Locality: Halásztelek
Comments:

sta	dist	azm	phase	hr mn sec	res
BUD	12.3	353	iPgC	20:23:21.70	0.00
			iSg	23:23.70	-0.02
PKS8	61.8	207	ePgD	20:23:30.60	0.37
			iSg	23:38.80	-0.10
PKSM	132.8	193	iSn	20:23:59.30	-0.06

71.

1999-10-15 time: 18:16:13.88 UTC ML= 1.3
lat: 46.659N lon: 18.454E h= 0.1 km
erh= 1.0km erz= 169km
nr= 6 gap=248 rms=0.10
Locality: Pincehely
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSM	51.7	164	iPgC	18:16:23.00	-0.11
			iSg	16:30.40	0.09
PKS2	61.1	108	iPg	18:16:24.90	0.11
			iSg	16:33.20	-0.10
PKS7	69.1	51	ePg	18:16:26.20	-0.02
			eSg	16:35.90	0.05

72.

1999-10-16 time: 2:55:40.17 UTC ML= 1.8
lat: 47.889N lon: 19.360E h= 3.2 km
erh= ---km erz= ---km
nr= 4 gap=341 rms=0.41
Locality: Szécsénke
Comments:

sta	dist	azm	phase	hr mn sec	res
PENC	12.4	208	iPgC	2:55:42.00	-0.47
			iSg	55:44.50	0.24
PKS7	94.8	189	ePg	2:55:57.70	0.59
			eSg	56:10.30	-0.02

73.

1999-10-18 time: 4:08:18.22 UTC ML=
lat: 48.363N lon: 17.712E h= 0.8 km
erh= 6.1km erz= 5.5km
nr= 16 gap=171 rms=1.36
Locality: Slovakia
Comments:

sta	dist	azm	phase	hr mn sec	res
ZST	48.9	248	Pg	4:08:26.00	-0.94
			eSg	08:33.10	-0.65
SOP	114.5	229	ePg	4:08:38.20	-0.46
			eSg	08:54.00	-0.61
PENC	133.2	119	iPnC	4:08:41.10	-0.65
BUD	138.4	135	ePn	4:08:43.50	1.09
			eSn	09:04.00	2.72
PKS8	180.2	156	iPnC	4:08:47.10	-0.52
ARSA	205.4	233	iPnC	4:08:53.40	2.65
			iSn	09:19.60	3.47
MOA	262.9	257	iPnC	4:08:55.90	-2.03
			iSn	09:32.90	4.00
PRU	293.5	308	ePn	4:09:03.30	1.56
			eSn	09:34.90	-0.78

Hypocenter Parameters

KHC	315.8	286	ePn	4:09:07.50	2.98
			eSn	09:44.00	3.36

74.

1999-10-28 time: 16:06:48.71 UTC ML= 2.9
lat: 48.316N lon: 19.007E h= 10.0 km
erh= 3.8km erz= 3.2km
nr= 18 gap=164 rms=0.94
Locality: Slovakia
Comments:

sta	dist	azm	phase	hr mn sec	res
SRO	76.1	223	Pg	16:07:02.50	0.08
			Sg	07:13.40	0.29
BUD	92.5	179	iPgC	16:07:05.90	0.57
			eSg	07:16.00	-2.29
PKSC	112.4	202	ePnC	16:07:08.20	-0.28
			iSn	07:23.70	-0.20
ZST	142.0	265	Pn	16:07:12.70	0.52
			Sn	07:29.70	-0.78
MORC	194.6	327	Pn	16:07:18.50	-0.23
			Sn	07:41.50	-0.64
VRAC	208.8	302	Pn	16:07:20.40	-0.10
			Sn	07:44.40	-0.89
OJC	219.4	15	ePn	16:07:21.10	-0.73
			iSn	07:48.20	0.54
KSP	342.8	325	ePn	16:07:47.50	10.29
PTJ	353.0	221	ePn	16:07:44.20	5.72
MOA	357.0	262	iPn	16:07:50.10	11.12
PRU	375.1	300	Sn	16:08:22.10	-0.11
KHC	409.6	283	ePn	16:07:47.50	1.96
			eSn	08:40.00	10.14
BRG	463.5	308	ePn	16:08:10.70	18.44

75.

1999-10-29 time: 18:37:04.61 UTC ML= 2.6
lat: 48.325N lon: 19.004E h= 10.0 km
erh= 6.6km erz= 8.6km
nr= 11 gap=164 rms=0.75
Locality: Slovakia
Comments:

sta	dist	azm	phase	hr mn sec	res
BUD	93.6	179	iPgC	18:37:21.50	0.08
			eSg	37:33.00	-1.54
ZST	141.9	264	ePn	18:37:29.90	1.83
			eSn	37:45.90	-0.46
MORC	193.6	327	Pn	18:37:34.70	0.19
			Sn	37:57.50	-0.32
VRAC	208.0	302	Pn	18:37:36.50	0.19
			Sn	38:00.60	-0.42
OJC	218.4	15	ePn	18:37:37.10	-0.51
			eSn	38:02.90	-0.44
PRU	374.4	300	eSn	18:38:48.10	10.15
KHC	409.1	283	ePn	18:38:03.50	2.12
			eSn	38:58.50	12.84

76.

1999-11-19 time: 11:10:02.65 UTC ML= 1.6
lat: 47.479N lon: 18.359E h= 0.1 km
erh= ---km erz= ---km
nr= 4 gap=351 rms=0.53
Locality: Vértes mt.
Comments: (explosion)

sta	dist	azm	phase	hr mn sec	res
PKSC	12.4	152	iPgU	11:10:04.74	-0.12
			iSg	10:06.23	-0.35
PKS8	70.9	160	ePg?	11:10:16.98	1.67
			eSg	10:25.93	0.74

77.

1999-11-19 time: 19:19:16.91 UTC ML= 0.9
lat: 47.381N lon: 18.250E h= 10.0 km
erh=23.7km erz=16.1km
nr= 6 gap=283 rms=1.14
Locality: Mór
Comments:

sta	dist	azm	phase	hr mn sec	res
PKSC	14.1	90	ePgD	19:19:19.12	-0.88
			iSg	19:22.74	0.34
PKS8	64.5	150	iPgD	19:19:30.18	1.61
			iSg	19:37.39	-0.27
PKSM	133.3	167	iPn	19:19:42.78	3.49
			iSn	19:54.96	-1.79

78.

1999-11-29 time: 15:12:14.55 UTC ML= 2.8
lat: 45.867N lon: 16.034E h= 8.1 km
erh= 2.9km erz= 1.2km
nr= 20 gap=231 rms=0.71
Locality: Croatia
Comments:

sta	dist	azm	phase	hr mn sec	res
ZAG	5.2	217	iPgD	15:12:15.80	-0.47
			iSg	12:17.50	-0.11
PTJ	6.7	315	iPgD	15:12:16.00	-0.43
			iSg	12:18.20	0.31
CESS	45.9	285	iPg	15:12:23.39	0.52
			iSg	12:29.71	0.36
DOBS	53.9	306	iPgC	15:12:24.12	-0.16
			iSg	12:31.60	-0.27
VBY	72.7	236	iPg	15:12:26.98	-0.64
			iSg	12:37.47	-0.34
BISS	111.5	321	iPn	15:12:33.83	-0.63
			iSn	12:46.51	-3.47
LJU	118.5	280	iPn	15:12:36.15	0.82
			iSn	12:51.48	-0.05
OBKA	135.1	302	iPnD	15:12:38.30	0.90
			iSn	12:54.50	-0.72
ARSA	158.8	346	iPnD	15:12:41.50	1.15
			iSn	12:59.80	-0.67
VOY	167.0	276	ePn	15:12:43.50	2.12
			eSn	13:04.10	1.80

79.

1999-12-03 time: 10:08:48.13 UTC ML= 1.6
lat: 47.458N lon: 18.555E h= 4.5 km
erh= 1.1km erz= 0.7km
nr= 6 gap=311 rms=0.75
Locality: Vértes mt.
Comments: (explosion)

sta	dist	azm	phase	hr mn sec	res
PKSC	12.4	226	iPgC	10:08:50.70	0.21
			iSg	08:51.50	-0.83
PKS9	99.1	192	iPgC	10:09:07.20	1.35
			eSg	09:21.20	1.54
PKSM	138.7	177	iPnC	10:09:11.90	0.02
			eSn	09:29.20	-1.21

80.

1999-12-14 time: 1:58:19.92 UTC ML= 2.7
lat: 46.239N lon: 16.312E h= 10.0 km
erh= 5.4km erz= 3.0km
nr= 23 gap=237 rms=1.54
Locality: Croatia
Comments:

sta	dist	azm	phase	hr mn sec	res
PTJ	45.1	216	iPg	1:58:27.50	-0.67
			iSg	58:34.50	-0.11
ZAG	51.8	208	iPg	1:58:29.05	-0.29
			iSg	58:36.19	-0.51
DOBS	65.8	261	iPgD	1:58:31.34	-0.46
			eSg	58:41.39	0.32
BISS	101.7	297	iPgD	1:58:36.81	-1.36
			iSg	58:49.03	-3.38
VBY	115.7	225	ePn	1:58:39.75	-0.35
			iSn	58:54.73	-1.11
ARSA	127.5	332	iPnD	1:58:41.20	-0.37
			iSn	58:58.30	-0.17
OBKA	138.9	282	iPnC	1:58:44.20	1.21
			iSn	59:03.00	2.01
LJU	139.6	261	ePn	1:58:44.38	1.30
CEY	156.3	249	ePn	1:58:45.31	0.15
			eSn	59:07.46	2.61
VOY	188.3	263	ePn	1:58:51.70	2.55
			eSn	59:17.00	5.04
MOA	237.1	319	iPnD	1:58:56.10	0.87
			iSn	59:23.70	0.92
KBA	245.5	292	Pn	1:59:02.60	6.32
			iSn	59:33.30	8.65

81.

1999-12-15 time: 11:03:43.39 UTC ML= 1.4
lat: 47.456N lon: 18.497E h= 4.4 km
erh=16.0km erz= 6.2km
nr= 5 gap=327 rms=0.48
Locality: Vértes mt.
Comments: (explosion)

sta	dist	azm	phase	hr mn sec	res
PKSC	9.5	208	iPgC	11:03:45.50	0.24
			iSg	03:46.60	-0.12
PKS9	98.0	190	iPgC	11:04:02.00	1.08
PKSM	138.8	175	iPn	11:04:06.80	-0.37
			eSn	04:23.20	-2.52

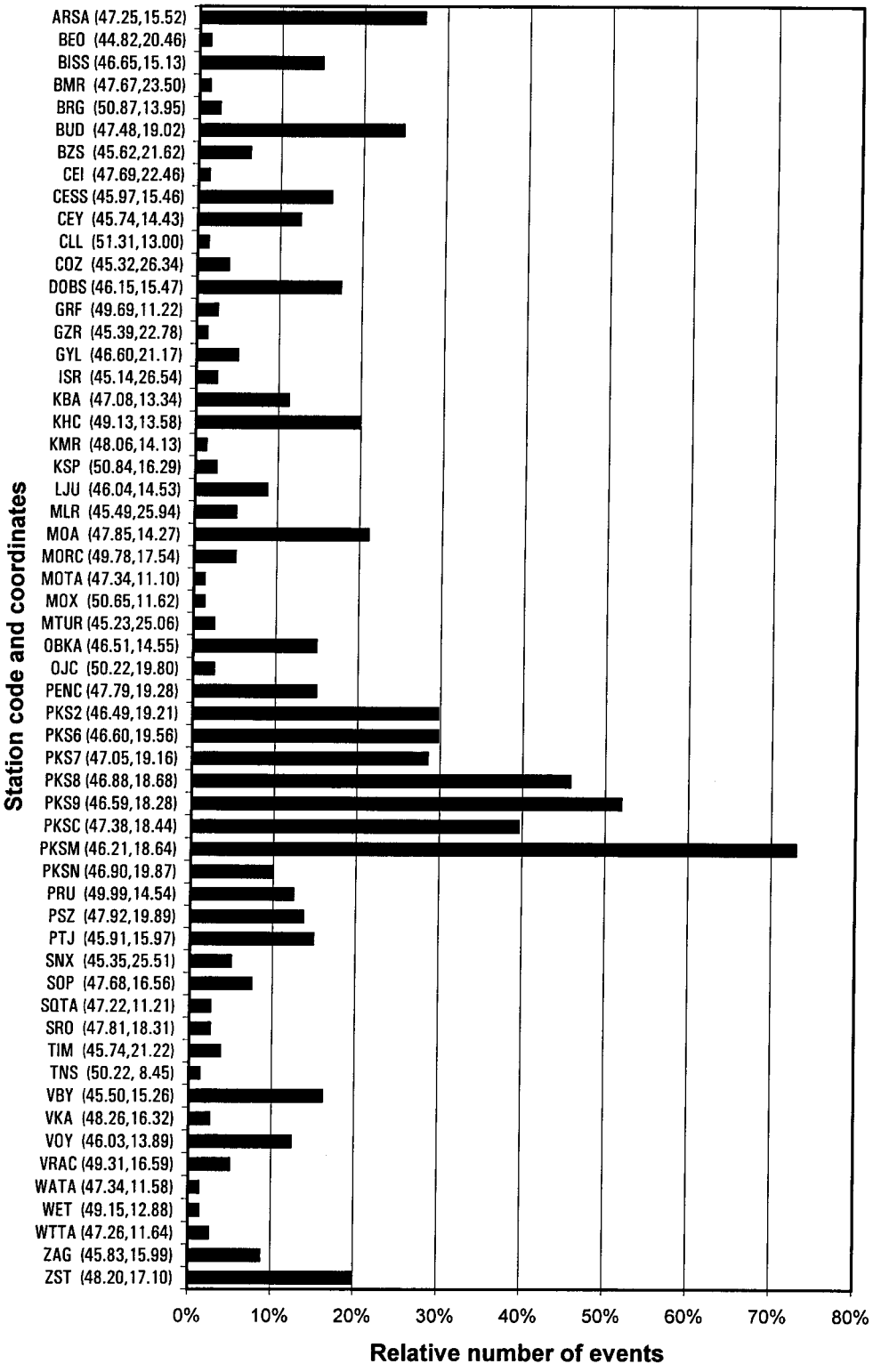


Figure 3.3. *Contribution of stations to hypocenter determination.*

4.

SIGNIFICANT EARTHQUAKES IN 1999

(Earthquakes that was felt in Hungary)

4 January 1999	- Nagyhódos
4 June 1999	- Siklós
3 August 1999	- Taktabáj
3 September 1999	- Békés

METHOD USED FOR ESTIMATION OF INTENSITY

The earthquake effects (macroseismic observations) are usually gathered on questionnaires. Based on these reports the intensity values were estimated by a computer algorithm (Zsíros et al, 1990 and Zsíros 1994).

The assigned intensities correspond to the *European Macroseismic Scale 1998 (EMS)* edited by Grünthal (1998). (APPENDIX A)

HYPOCENTER PARAMETERS

4 January 1999 - Nagyhódos

Date:	1999/01/04
Origin Time:	00:30:36.2 UTC
Latitude and Longitude:	47.982N 22.850E (S.D. 6.4 km)
Depth:	10.0 km (S.D. 592 km)
Magnitude:	3.8 ML
Maximum Intensity:	4.5

DISCUSSION

On January 4th, an earthquake with a magnitude of 3.8 ML was felt at Nagyhódos - Kispalád area of about 100-150 km^2, with a maximum intensity of 4-5 EMS.

Seismograms of the event are shown in Figure 4.1.

The intensity distribution of the event is shown in Table 4.1. and Figure 4.2.

4 January 1999 - Nagyhódos

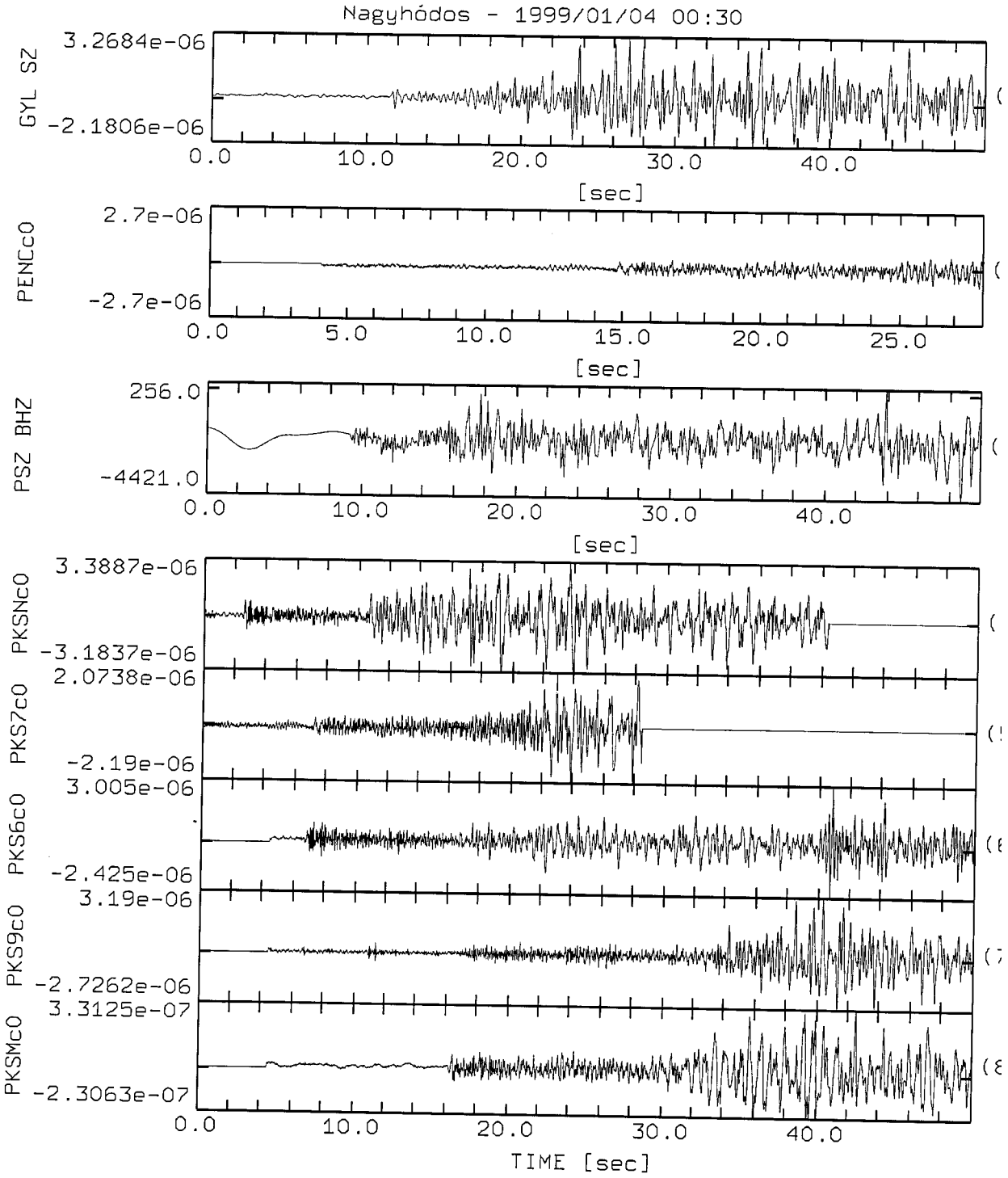


Figure 4.1. Seismograms of the Nagyhódos Earthquake 4th January 1999, 0:30:36 UTC. (GYL, PENC, PSZ, PKSN, PKS7, PKS6, PKS9 AND PKSM vertical components)
The vertical axis is ground velocity in m/s.

Table 4.1. *Intensity distribution of the Nagyhódos Earthquake 4th January 1999, 0:30:36 UTC*

	Location	Coordinates	I	R	N
1	Fehérgyarmat	47.984 N 22.510 E	.0	0.%	1
2	Gacsály	47.928 N 22.762 E	3.5	43.%	2
3	Kispalád	48.027 N 22.838 E	4.5	37.%	1
4	Mánd	48.002 N 22.610 E	.0	0.%	1
5	Mátészalka	47.949 N 22.309 E	.0	0.%	1
6	Nagyhódos	47.973 N 22.857 E	4.5	32.%	2
7	Nyírbátor	47.840 N 22.119 E	3.0	33.%	3
8	Szeghalom	47.022 N 21.169 E	.0	0.%	1
9	Tiszabecs	48.098 N 22.822 E	4.0	38.%	2
10	Tisztaberek	47.955 N 22.797 E	4.0	32.%	2
11	Túristvándi	48.055 N 22.650 E	.0	0.%	2
12	Vámosoroszi	47.992 N 22.685 E	4.0	23.%	2
13	Vásárosnamény	48.119 N 22.314 E	3.0	42.%	3

I - intensity
R - relative reliability
N - number of reports

4 January 1999 - Nagyhódos

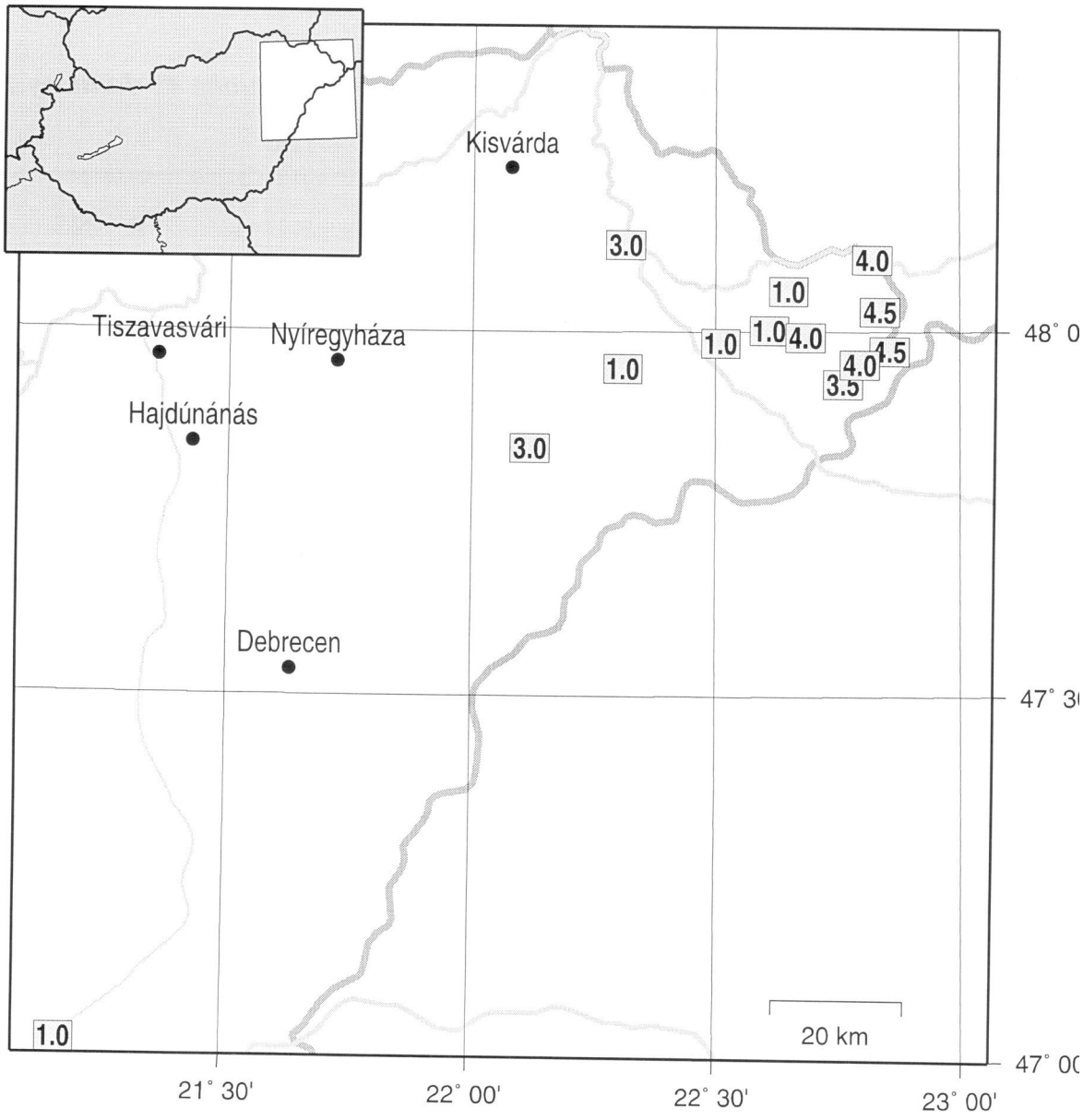


Figure 4.2. Intensity distribution of the Nagyhódos Earthquake 4^{h} January 1999, 0:30:36 UTC

HYPOCENTER PARAMETERS

4 June 1999 - Siklós

Date:	1999/06/04
Origin Time:	02:09:45.1 UTC
Latitude and Longitude:	45.826N 18.302E (S.D. 12.4 km)
Depth:	6.6 km (S.D. 6.6 km)
Magnitude:	3.0 ML
Maximum Intensity:	4

DISCUSSION

On June 4th, an earthquake with a magnitude of 3.0 ML occurred near to the Hungarian - Croatian border. Maximum intensity of 4 was reported from a small area of about 100 km^2 in southern part of Hungary

Seismograms of the event are shown in Figure 4.3.

The intensity distribution of the event is shown in Table 4.2. and Figure 4.4.

4 June 1999 - Siklós

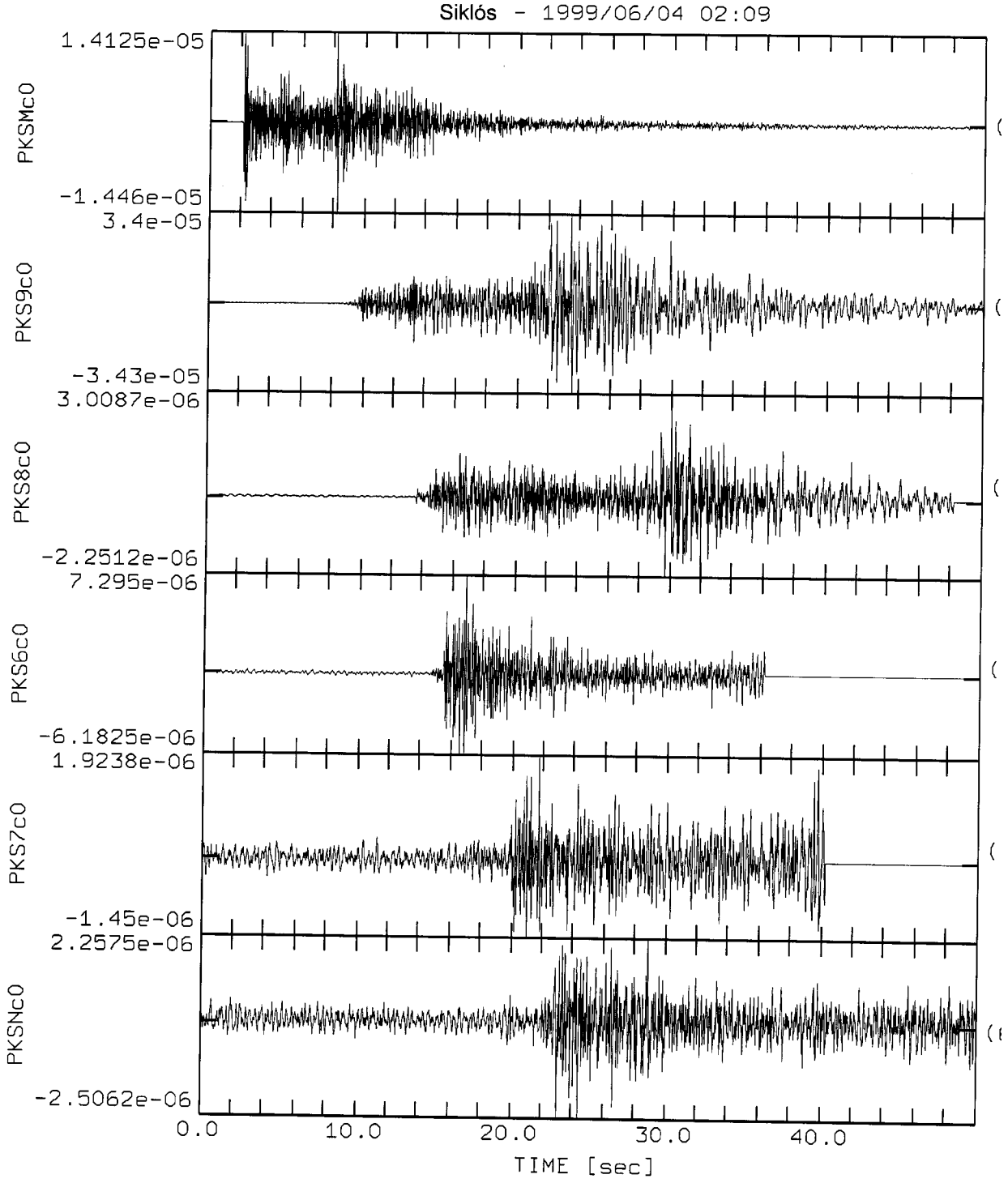


Figure 4.3. Seismograms of the Siklós Earthquake 4th June 1999, 2:09:45 UTC (PKSM, PKS9, PKS8, PKS6, PKS7 and PKSN vertical components) The vertical axis is ground velocity in m/s.

Table 4.2. *Intensity distribution of the Siklós Earthquake 4th June 1999, 2:09:45 UTC*

	Location	Coordinates	I	R	N
1	Alsószentmárton	45.795 N 18.309 E	.0	0.%	1
2	Beremend	45.792 N 18.436 E	.0	0.%	1
3	Drávaszabolcs	45.809 N 18.216 E	.0	0.%	1
4	Egyházasharaszti	45.813 N 18.339 E	4.0	50.%	2
5	Harkány	45.850 N 18.238 E	4.0	54.%	2
6	Kisharsány	45.864 N 18.367 E	3.5	39.%	2
7	Kiskassa	45.954 N 18.402 E	3.5	40.%	1
8	Magyarbóly	45.846 N 18.491 E	.0	0.%	2
9	Majs	45.909 N 18.603 E	.0	0.%	1
10	Máriagyűd	45.872 N 18.274 E	3.5	36.%	1
11	Nagyharsány	45.847 N 18.394 E	.0	0.%	1
12	Nagytótfalu	45.867 N 18.347 E	3.5	40.%	1
13	Siklós	45.857 N 18.302 E	4.0	47.%	5
14	Villány	45.870 N 18.462 E	.0	0.%	1
15	Villánykövesd	45.883 N 18.430 E	.0	0.%	1
16	Újpetre	45.931 N 18.370 E	.0	0.%	1

I - intensity
R - relative reliability
N - number of reports

4 June 1999 - Siklós

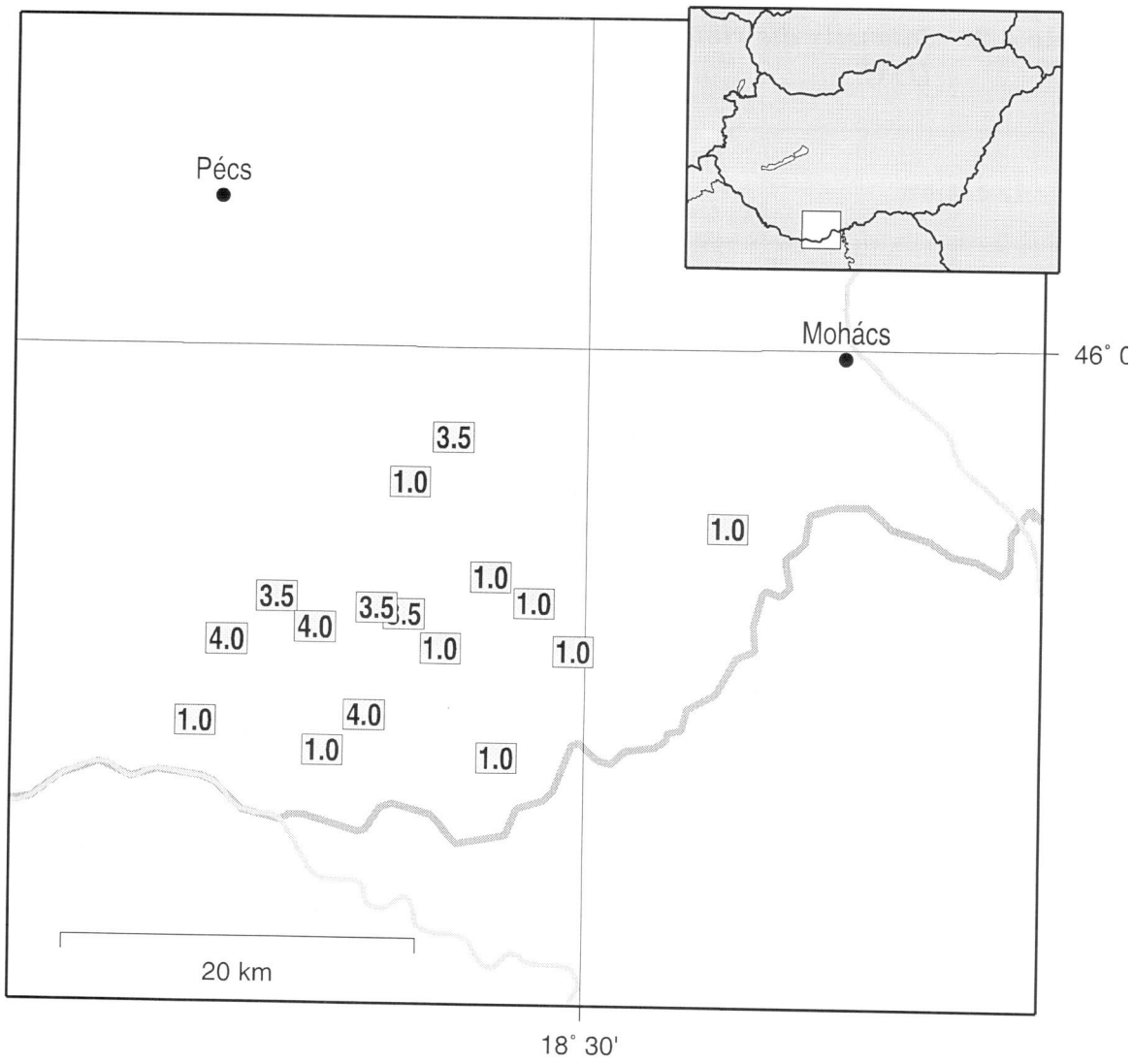


Figure 4.4. Intensity distribution of the Siklós Earthquake 4^{h} June 1999, 2:09:45 UTC

HYPOCENTER PARAMETERS

3 August 1999 - Taktabáj

Date:	1999/08/03
Origin Time:	06:51:38.0 UTC
Latitude and Longitude:	48.062N 21.336E (S.D. --km)
Depth:	15.0 km (S.D. --km)
Magnitude:	2.8 ML
Maximum Intensity:	5

DISCUSSION

The Taktabáj earthquake of 3rd August with a magnitude of 2.8 ML was unexpectedly strongly felt at the epicenter area. The macroseismic survey carried out at the time of the event resulted a maximum intensity of 5 at the epicenter however, the area where it was felt was extremely small.

Seismograms of the event are shown in Figure 4.5.

The intensity distribution of the event is shown in Table 4.3. and Figure 4.6.

3 August 1999 - Taktabáj

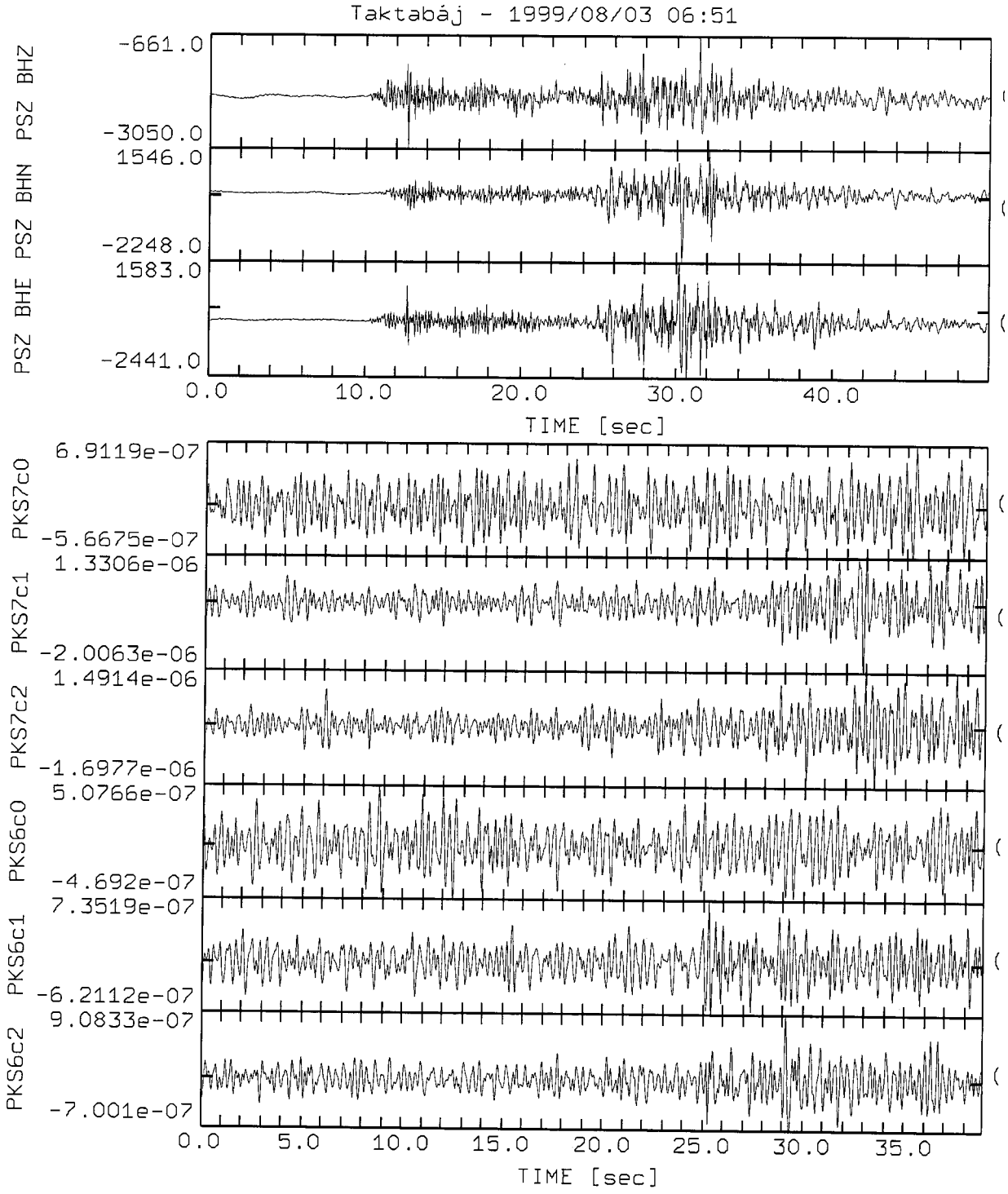


Figure 4.5. Seismograms of the Taktabáj Earthquake 3rd August 1999, 6:51:38 UTC (PSZ, PKS7, and PKS6 three components).
The vertical axis is ground velocity in m/s.

Table 4.3. *Intensity distribution of the Taktabáj Earthquake 3rd August 1999, 6:51:38 UTC*

	Location	Coordinates	I	R	N
1	Csobaj	48.049 N 21.340 E	5.0	34.%	2
2	Prügy	48.084 N 21.248 E	.0	0.%	2
3	Taktabáj	48.062 N 21.310 E	5.0	36.%	2
4	Taktaharkány	48.086 N 21.134 E	.0	0.%	2
5	Taktakenéz	48.052 N 21.218 E	.0	0.%	2
6	Tiszaladány	48.062 N 21.409 E	.0	0.%	2
7	Tiszalök	48.016 N 21.374 E	.0	0.%	2
8	Tiszatardos	48.040 N 21.381 E	.0	0.%	2

I - intensity
R - relative reliability
N - number of reports

3 August 1999 - Taktabáj

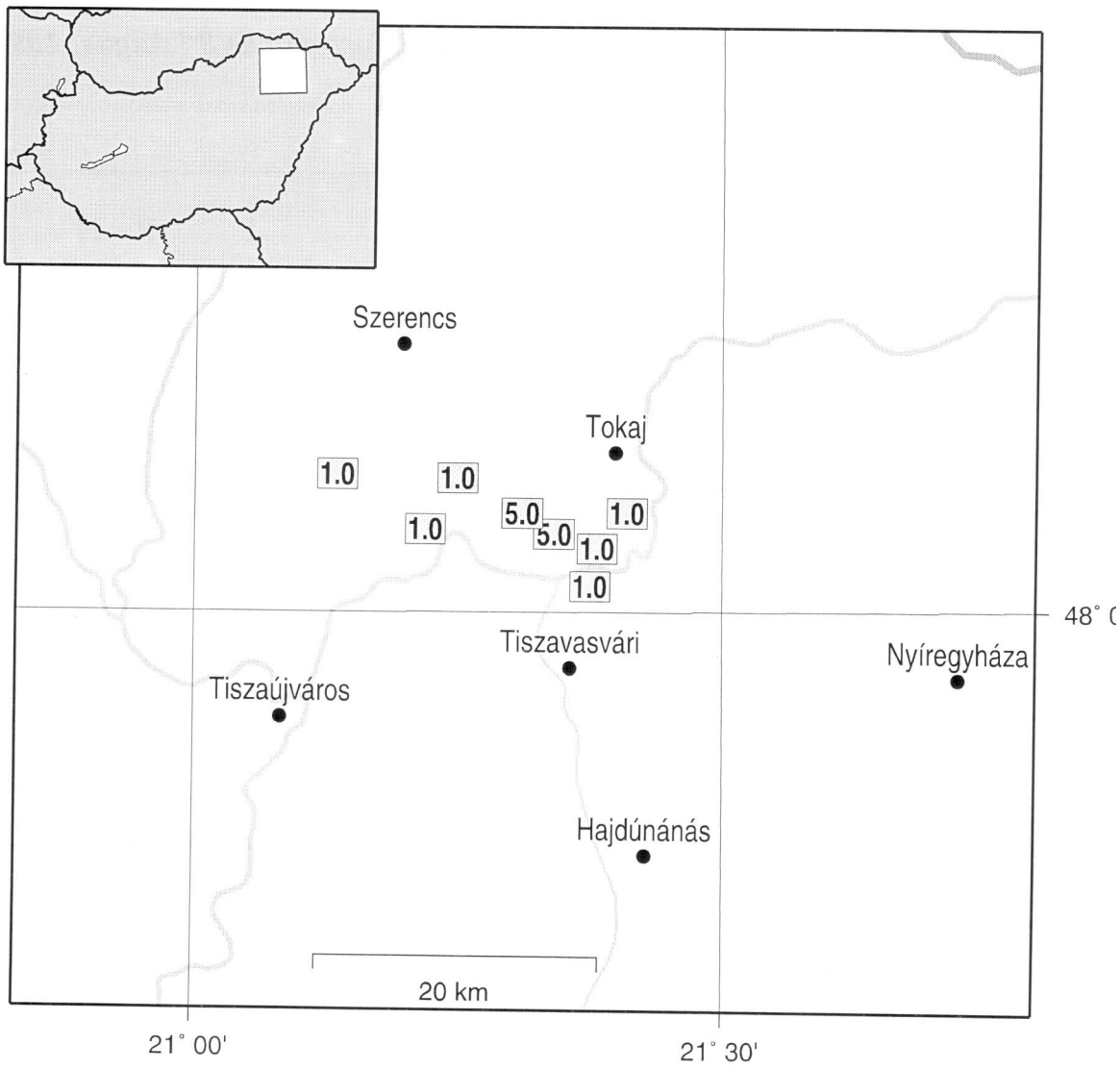


Figure 4.6. Intensity distribution of the Taktabáj Earthquake 3rd August 1999, 6:51:38 UTC

HYPOCENTER PARAMETERS

3 September 1999 - Békés

Date:	1999/09/03
Origin Time:	09:38:19.1 UTC
Latitude and Longitude:	46.590N 21.121E (S.D. 8.6 km)
Depth:	18.2 km (S.D. 2.9 km)
Magnitude:	3.4 ML
Maximum Intensity:	3

DISCUSSION

The Békés earthquake of 3 September was slightly felt with intensity 3 at the epicenter area.

Seismograms of the event are shown in Figure 4.7.

The intensity distribution of the event is shown in Table 4.4. and Figure 4.8.

3 September 1999 - Békés

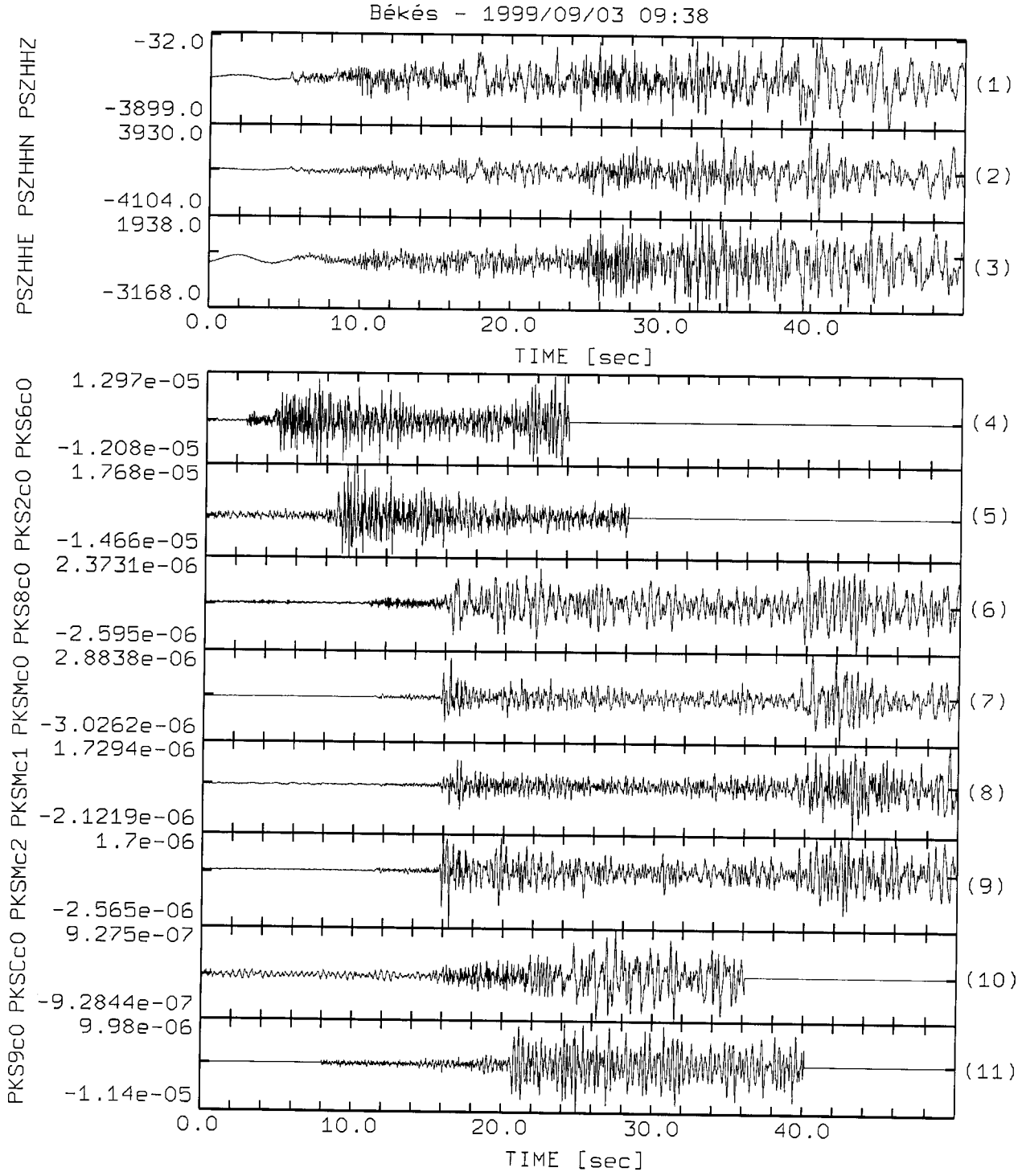


Figure 4.7. Seismograms of the Békés Earthquake of 3rd September 1999, 09:38:19 UTC (PSZ and PKSM three components, PKS6, PKS2, PKS8, PKSC, and PKS9 vertical components).
The vertical axis is ground velocity in m/s.

Table 4.4. *Intensity distribution of the Békés Earthquake of 3rd September 1999, 09:38:19 UTC*

	Location	Coordinates	I	R	N
1	Békés	46.774 N 21.128 E	3.0	36.%	3
2	Békéscsaba	46.675 N 21.081 E	3.0	34.%	3
3	Bélmegyer	46.870 N 21.177 E	.0	0.%	2
4	Doboz	46.735 N 21.241 E	.0	0.%	2
5	Gerla	46.702 N 21.182 E	.0	0.%	1
6	Mezőberény	46.820 N 21.016 E	.0	0.%	2
7	Murony	46.762 N 21.029 E	.0	0.%	2

I - intensity
R - relative reliability
N - number of reports

3 September 1999 - Békés

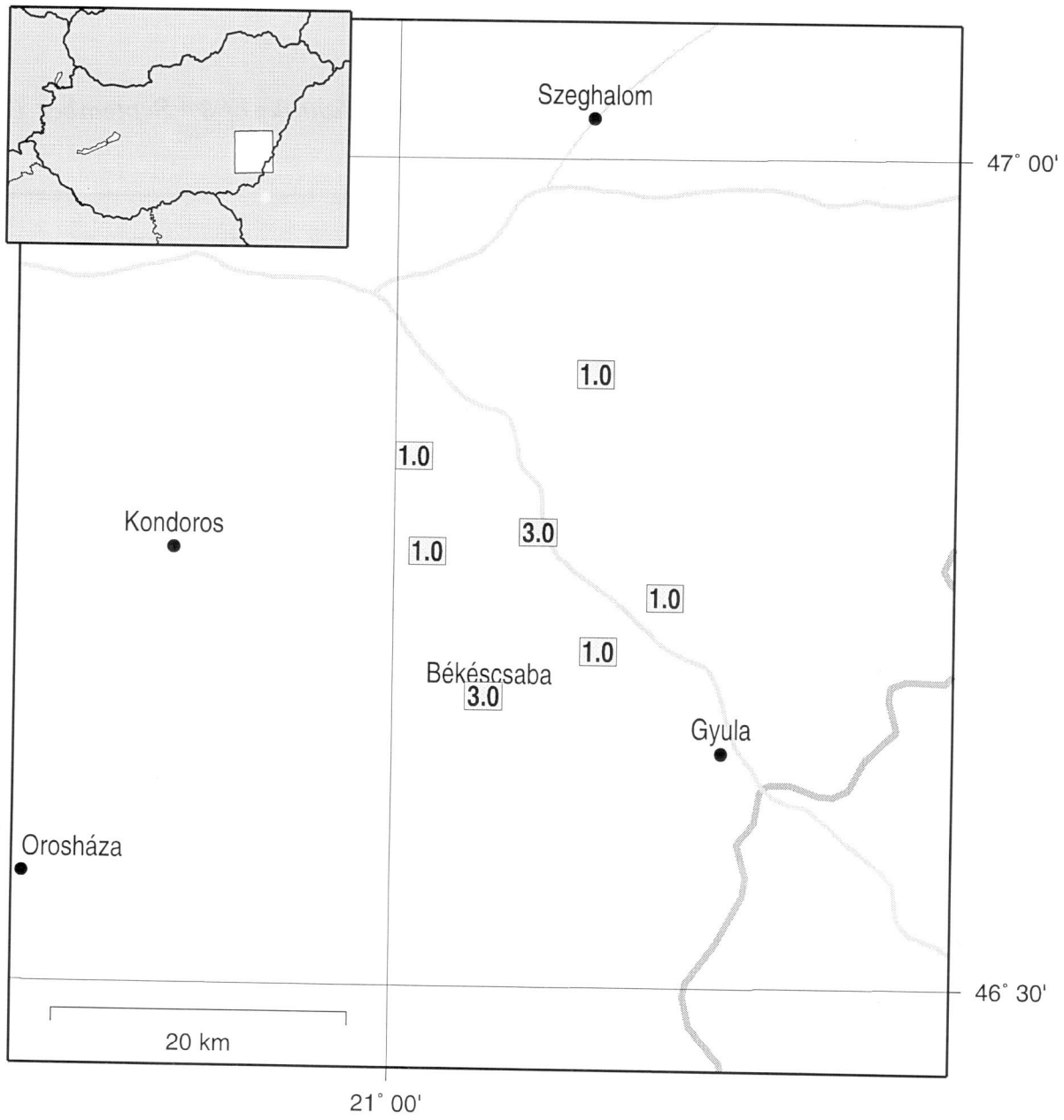


Figure 4.8. Intensity distribution of the Békés Earthquake of 3rd September 1999, 09:38:19 UTC

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APPENDIX A

EUROPEAN MACROSEISMIC SCALE (EMS)

EMS INTENSITY SCALE

1 ☞ **Not felt**

Not felt, even the most favourable circumstances.

2 ☞ **Scarcely felt**

Vibration is felt only by individual people at rest in houses, especially on upper floors of buildings.

3 ☞ **Weak**

The vibration is weak and is felt indoors by a few people. People at rest feel a swaying or light trembling.

4 ☞ **Largely observed**

The earthquake is felt indoors by many people, outdoors by very few. A few people are awakened. The level of vibration is not frightening. Windows, doors and dishes rattle. Hanging objects swing.

5 ☞ **Strong**

The earthquake is felt indoors by most, outdoors by few. Many sleeping people awake. A few run outdoors. Buildings tremble throughout. Hanging objects swing considerably. China and glasses clatter together. The vibration is strong. Top heavy objects topple over. Doors and windows swing open or shut.

6 ☞ **Slightly damaging**

Felt by most indoors and many outdoors. Many people in buildings are frightened and run outdoors. Small objects fall. Slight damage to many ordinary buildings eg. fine cracks in plaster and small pieces of plaster fall.

7 ☞ **Damaging**

Most people are frightened and run outdoors. Furniture is shifted and objects fall from shelves in large numbers. Many ordinary buildings suffer moderate damage: small cracks in walls, partial collapse of chimneys.

8 ☞ **Heavily damaging**

Furniture may be overturned. Many ordinary buildings suffer damage: chimneys fall, large cracks appear in walls and few buildings may partially collapse.

9 ☞ **Destructive**

Monuments and columns fall or are twisted. Many ordinary buildings partially collapse and few collapse completely.

10 ☞ **Very destructive**

Many ordinary buildings collapse.

11 ☞ **Devastating**

Most ordinary buildings collapse.

12 ☞ **Completely devastating**

Practically all structures above and below ground are heavily damaged or destroyed.

(For details see Grünthal, 1998)

APPENDIX B

SIGNIFICANT EARTHQUAKES OF THE WORLD

1999

Earthquakes of magnitude 6.5 or greater or ones that caused fatalities, injuries or substantial damage.

Source: U.S. Geological Survey
National Earthquake Information Center

Significant Earthquakes of the World, 1999

DATE	ORIGIN TIME UTC HR MN SEC	GEOGRAPHIC COORDINATES LAT	LONG	DEPTH	MAGNITUDES GS MB	Msz	SD	NO. STA USED	REGION, CONTRIBUTED MAGNITUDES AND COMMENTS
JAN 02	17 55 08.1	27.277 N	101.050 E	41 *	4.5		0.9	29	SICHUAN, CHINA. Two people injured and some livestock killed in Ninglang County, Yunnan Province.
JAN 19	03 35 33.8	4.596 S	153.235 E	114 D	5.8	6.4	1.3	178	NEW IRELAND REGION, P.N.G. Mw 7.0 (GS), 7.0 (HRV). Me 6.2 (GS). Es=4.6*10**13 Nm (GS). Mo=3.6*10**19 Nm (GS). Mo=3.7*10**19 Nm (HRV). Mo=3.7*10**19 Nm (PPT). Complex earthquake, with two larger events occurring about 5 and 10 seconds after onset.
JAN 25	18 19 16.8	4.461 N	75.724 W	17 G	5.9	5.7	1.0	497	COLOMBIA. Mw 6.2 (GS), 6.2 (HRV). Me 6.4 (GS). ML 6.2 (RSNC). Es=9.6*10**13 Nm (GS). Mo=2.1*10**18 Nm (GS). Mo=2.0*10**18 Nm (HRV). Mo=2.5*10**18 Nm (PPT). At least 1,185 people killed, over 700 missing and presumed killed, over 4,750 injured and about 250,000 homeless. The most affected city was Armenia where 907 people were killed and about 60 percent of the buildings were destroyed, including the police and fire stations. About 60 percent of the buildings were destroyed at Calarca and about 50 percent of the houses were destroyed at Pereira. Landslides blocked several roads including the Manizales-Bogota road. Damage occurred in Caldas, Huila, Quindio, Risaralda, Tolima and Valle del Cauca Departments.
JAN 28	08 10 05.4	52.886 N	169.123 W	67 D	6.3	6.1	0.9	586	FOX ISLANDS, ALEUTIAN ISLANDS. Mw 6.6 (GS), 6.6 (HRV). Me 6.5 (GS). Es=1.1*10**14 Nm (GS). Mo=8.1*10**18 Nm (GS). Mo=9.4*10**18 Nm (HRV). Mo=9.3*10**18 Nm (PPT). Minor damage at Nikolski. Also felt at Akutan, Dutch Harbor and Unalaska.
JAN 30	12 24 25.0*	4.511 N	75.890 W	10 G	4.0		1.4	12	COLOMBIA. ML 4.2 (RSNC). Five people injured and five houses damaged at Buena Vista.
FEB 02	13 45 16.8	38.193 N	1.566 W	10 G	4.8		1.4	201	SPAIN. mbLg 5.2 (MDD). ML 5.2 (LDG). Twenty people injured in the Mula area. Buildings damaged (VII) at Mula and Puebla de Mula. Felt (VI) in the Archena-Bullas area; (V) in the Alhama de Murcia-Molina de Segura-Murcia area and at Abaran, Albatana, Cehegin, Cieza, Elche and Hornos; (IV) at Abanilla, Albacete, Alcoy, Alicante, Fortuna, Moratalla, Orihuela and San Pedro del Pinatar; (III) at Requena, Segorbe, Torrevieja, Ubeda and Xativa. Felt in Albacete, Alicante, Almeria, Castellon, Cuenca, Madrid, Murcia and Valencia Provinces. Felt as far as Valladolid. Landslides temporarily closed Highway C-415 in the Alcantarilla-Mula area.
FEB 06	21 47 59.4	12.853 S	166.697 E	90 D	6.3	7.3	1.2	279	SANTA CRUZ ISLANDS. Mw 7.3 (GS), 7.3 (HRV). Me 7.2 (GS). mb 6.7 (BRK). Es=1.3*10**15 Nm (GS). Mo=9.1*10**19 Nm (GS). Mo=1.1*10**20 Nm (HRV). Mo=2.2*10**20 Nm (PPT). Complex earthquake, with a small event preceding a much larger one by about 2.5 seconds.
FEB 11	14 08 51.6	34.259 N	69.364 E	33 N	5.4	5.8	1.3	124	AFGHANISTAN. Mw 5.9 (GS), 6.0 (HRV). Mo=9.0*10**17 Nm (GS). Mo=1.3*10**18 Nm (HRV). Seventy people killed, 500 injured, at least 14,000 homeless and 7,000 houses destroyed in Lowgar and Vardak Provinces. Several people injured at Kabul. Felt at Islamabad and Peshawar, Pakistan.
FEB 21	18 14 37.9	43.214 N	46.825 E	65 *	5.1		1.2	252	EASTERN CAUCASUS. Mw 5.3 (HRV). Mo=1.1*10**17 Nm (HRV). At least one person killed, 20 injured and several homes badly damaged (VI) in the Kizilyurt area. Felt (VI) at Dylym; (V) at Makhachkala and Novolakskoye; (IV) at Gunib, Khasavyurt and Khunzakh; (III) at Pyatigorsk and Sergokala.
MAR 04	05 38 26.5	28.343 N	57.193 E	33 N	6.2	6.5	0.9	368	SOUTHERN IRAN. Mw 6.4 (GS), 6.6 (HRV), 6.4 (CSEM). Me 6.0 (GS). Es=2.2*10**13 Nm. Mo=4.1*10**18 Nm (GS). Mo=1.0*10**19 Nm (HRV). Mo=4.7*10**18 Nm (CSEM). One person killed and at least 517 houses damaged in the Kerman area. Felt at Baft, Bam, Esfandaqeh, Rafsanjan, Ravar, Sirjan and

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										Zehmakan. Also felt at Dubai, United Arab Emirates.
MAR	04	08 52 01.9	5.397 N	121.937 E	33 N	6.4	6.5	1.2	251	CELEBES SEA. Mw 7.0 (GS), 7.1 (HRV). Me 6.9 (GS). Es=5.9*10**14 Nm (GS). Mo=3.1*10**19 Nm (GS). Mo=4.9*10**19 Nm (HRV). Mo=9.2*10**19 Nm (PPT). Minor damage (V RF) at Zamboanga, Mindanao. Felt strongly on Basilan. Felt (IV RF) at Cagayan de Oro; (III RF) at Cotabato and General Santos; (II RF) at Dipolog; (I RF) at Kidapawan and Surigao, Mindanao. Also felt (I RF) at Canlaon, Negros and Iloilo, Panay.
MAR	07	20 35 44.1	15.766 S	179.526 W	33 N	5.4	6.1	1.0	127	FIJI ISLANDS REGION. Mw 6.1 (GS), 6.1 (HRV). Me 6.6 (GS). Es=1.9*10**14 Nm (GS). Mo=1.6*10**18 Nm (GS). Mo=1.7*10**18 Nm (HRV).
MAR	08	12 25 48.9	52.056 N	159.520 E	57 D	5.7		1.1	430	OFF EAST COAST OF KAMCHATKA. Mw 6.8 (GS), 6.9 (HRV), 7.0 (OBN). Me 6.4 (GS). Es=7.8*10**13 Nm. Mo=1.8*10**19 Nm (GS). Mo=2.6*10**19 Nm (HRV). Mo=3.5*10**19 Nm (OBN). Mo=2.8*10**19 Nm (PPT). Felt (V) at Petropavlovsk-Kamchatskiy. Also felt (III) at Severo-Kurilsk, Paramushir.
MAR	11	13 18 09.3	41.131 N	114.658 E	33 N	5.1	5.2	1.0	170	NORTHEASTERN CHINA. Mw 5.1 (HRV). ML 5.3 (BJI). Mo=5.9*10**16 Nm (HRV). Three people injured, at least 200 houses destroyed and 3,000 houses damaged in Zhangbei County. Felt as far as Beijing.
MAR	20	10 47 45.9	51.587 N	177.668 W	33 N	6.3	6.8	0.9	540	ANDREANOF ISLANDS, ALEUTIAN IS. Mw 6.8 (GS), 6.9 (HRV). Me 7.0 (GS). Es=8.3*10**14 Nm (GS). Mo=1.5*10**19 Nm (GS). Mo=2.7*10**19 Nm (HRV). Mo=2.8*10**19 Nm (PPT). Felt strongly on Adak and Amchitka. This may be a delayed aftershock of the June 10, 1996 magnitude 7.9 event.
MAR	25	23 31 11.4	36.397 N	140.469 E	83	4.9		0.7	146	NEAR EAST COAST OF HONSHU, JAPAN. Mw 5.2 (HRV). Mo=8.1*10**16 Nm (HRV). One person slightly injured in Ibaraki Prefecture. Felt (IV JMA) in Ibaraki; (III JMA) in northern Chiba, southeastern Fukushima and much of Tochigi; (II JMA) in much of Gumma and eastern Saitama Prefectures. Felt (I JMA) in the Tokyo area and as far north as southern Iwate Prefecture.
MAR	28	19 05 11.0	30.512 N	79.403 E	15 G	6.4	6.6	1.0	409	XIZANG-INDIA BORDER REGION. Mw 6.6 (GS), 6.6 (HRV), 6.6 (CSEM). Me 6.6 (GS). Es=1.7*10**14 Nm (GS). Mo=7.6*10**18 Nm (GS). Mo=7.8*10**18 Nm (HRV). Mo=1.0*10**19 Nm (CSEM). At least 61 people killed and 125 injured in the Chamoli district: 34 killed and 177 injured in the Rudraprayag district: 5 killed and 60 injured in the Tehri Garhwal district: 19 injured in the Bageshwar district: 13 injured in the Pauri Garhwal district, India. Over 21,100 houses destroyed. Many landslides blocked roads in the epicentral area.
MAR	31	05 54 42.1	5.827 N	82.616 W	10 G	5.9	6.1	1.1	273	SOUTH OF PANAMA. Mw 6.4 (GS), 6.4 (HRV). Me 7.0 (GS). MD 5.9 (UPA). ML 5.8 (CASC). Es=7.1*10**14 Nm (GS). Mo=4.1*10**18 Nm (GS). Mo=4.1*10**18 Nm (HRV). Mo=3.4*10**18 Nm (PPT).
APR	03	06 17 18.3	16.660 S	72.662 W	87 D	6.1	6.2	0.9	422	NEAR COAST OF PERU. Mw 6.8 (GS), 6.8 (HRV). Mo=1.5*10**19 Nm (GS). Mo=2.0*10**19 Nm (HRV). Mo=2.2*10**19 Nm (PPT). One person killed in the Camana area. Fifty people injured and at least 300 houses damaged (VI) in the Arequipa area. Felt (IV) at Nazca and Pisco; (III) at Ica and Moquegua; (II) at Cuzco and Lima. Also felt (V) at Arica and Putre; (IV) at Camarones, Camino, Codpa, Iquique and Pozo Almonte; (III) at Huara and Pica, Chile. Landslides temporarily blocked the Pan American Highway at four locations in southern Peru.
APR	05	11 08 04.0	5.591 S	149.568 E	150 G	6.2	7.0	1.0	233	NEW BRITAIN REGION, P.N.G. Mw 7.4 (GS), 7.4 (HRV). Me 7.3 (GS). Es=1.7*10**15 Nm (GS). Mo=1.3*10**20 Nm (GS). Mo=1.6*10**20 Nm (HRV). Mo=1.0*10**20 Nm (PPT). Felt strongly at Kimbe. Also felt at Port Moresby, New Guinea.

APR 08	13 10 34.0	43.607 N	130.350 E	566	D	6.4		0.8	645	E. RUSSIA-N.E. CHINA BORDER REG. Mw 7.1 (GS), 7.1 (HRV). Mo=5.8*10**19 Nm (GS). Mo=5.9*10**19 Nm (HRV). Mo=3.5*10**19 Nm (PPT). Felt (III) at Khabarovsk, Komsomolsk-na-Amure and Zeya; (II) at Nakhodka and Vladivostok, Russia. Felt in parts of Hebei, Heilongjiang and Jilin Provinces, China. Also felt in southern Hokkaido, northern Honshu and at Tokyo, Japan.
APR 13	10 38 48.4	21.422 S	176.460 W	164	D	6.4		0.8	464	FIJI ISLANDS REGION. Mw 6.8 (GS), 6.8 (HRV). Mo=1.5*10**19 Nm (GS). Mo=1.7*10**19 Nm (HRV). Mo=4.0*10**19 Nm (PPT).
APR 20	19 04 08.3	31.888 S	179.040 W	96	D	6.2		0.9	385	KERMADEC ISLANDS REGION. Mw 6.5 (GS), 6.5 (HRV). Mo=7.2*10**18 Nm (GS). Mo=6.1*10**18 Nm (HRV). Mo=1.0*10**19 Nm (PPT). Felt along the east coast of the North Island from Wairoa to Wellington.
APR 22	22 19 36.9	27.953 S	26.635 E	5	G	5.7	4.7	0.7	290	REPUBLIC OF SOUTH AFRICA. Two people killed in a gold mine and some buildings damaged in the Welkom area.
MAY 06	23 00 53.1	29.501 N	51.880 E	33	N	5.9	6.3	1.0	358	SOUTHERN IRAN. Mw 6.1 (GS), 6.2 (HRV). Mo=1.5*10**18 Nm (GS). Mo=2.6*10**18 Nm (HRV). At least 26 people killed, 100 injured and 800 houses destroyed in southwestern Fars Province. Felt at Kazerun and Shiraz. Also felt in parts of Bovir Ahmadi va Kohkiluyeh and Bushehr Provinces.
MAY 10	20 33 02.0	5.159 S	150.880 E	138	D	6.5	6.8	0.9	430	NEW BRITAIN REGION, P.N.G. Mw 7.1 (GS), 7.1 (HRV), mb 6.5 (BRK). Mo=4.9*10**19 Nm (GS). Mo=5.4*10**19 Nm (HRV). Mo=4.4*10**19 Nm (PPT). Felt on New Britain. Also felt at Port Moresby, New Guinea.
MAY 16	00 51 20.4	4.751 S	152.486 E	74		6.0	7.0	0.9	346	NEW BRITAIN REGION, P.N.G. Mw 7.0 (GS), 7.1 (HRV), Me 6.3 (GS). Es=7.2*10**13 Nm (GS). Mo=3.7*10**19 Nm (GS). Mo=4.7*10**19 Nm (HRV). Mo=4.0*10**19 Nm (PPT). Felt strongly on the Gazelle Peninsula. Also felt in other parts of New Britain and on New Ireland. Complex event.
MAY 17	10 07 56.4	5.165 S	152.877 E	27	G	5.5	6.9	1.0	271	NEW BRITAIN REGION, P.N.G. Mw 6.5 (GS), 6.7 (HRV), Me 6.0 (GS). Es=2.0*10**13 Nm (GS). Mo=5.5*10**18 Nm (GS). Mo=1.2*10**19 Nm (HRV). Mo=2.6*10**18 Nm (PPT).
JUN 04	09 12 50.0	40.802 N	47.448 E	33	N	5.4	5.0	1.2	305	EASTERN CAUCASUS. Mw 5.5 (GS), 5.4 (HRV), 5.5 (CSEM). Mo=2.2*10**17 Nm (GS). Mo=1.5*10**17 Nm (HRV). Mo=1.8*10**17 Nm (CSEM). Fifteen people injured, 50 houses damaged and about 2.5 million U.S. dollars damage in the Agdas area, Azerbaijan. Three people injured at Ucar and several houses damaged at Agali, Azerbaijan. Total damage in central Azerbaijan estimated at 5 million U.S. dollars. Felt in parts of Armenia and Georgia. Also felt in the Ardabil region, Iran.
JUN 07	07 45 49.0	8.586 N	125.854 E	33	N	5.2	5.4	1.3	72	MINDANAO, PHILIPPINE ISLANDS. Twelve people injured and at least 20 buildings damaged or destroyed (VI RF) at Bayugan. Felt (V RF) at Butuan and San Francisco; (IV RF) at Hinatuan and Lianga; (II RF) at Bislig and Cagayan de Oro; (I RF) on Camiguin.
JUN 15	20 42 05.9	18.386 N	97.436 W	70	G	6.4	6.5	1.1	516	CENTRAL MEXICO. Mw 6.9 (GS), 7.0 (HRV), Me 6.7 (GS). Es=2.4*10**14 Nm (GS). Mo=2.2*10**19 Nm (GS). Mo=3.4*10**19 Nm (HRV). Mo=4.0*10**19 Nm (PPT). Fourteen people killed, about 200 injured and considerable damage to thousands of buildings and several bridges in Puebla; one person killed by a landslide, dozens injured and damage to buildings and bridges in Veracruz; one person killed, dozens injured, many buildings and roads damaged in Oaxaca; one person killed and some buildings damaged in Morelos; one person died of a heart attack and some buildings damaged in Guerrero; two people died of heart attacks and minor damage to buildings in the Federal District. Dozens injured and damage in Mexico State and Tlaxcala; two people injured in Hidalgo. A railroad was damaged between Calco and Mixquic. Felt in much of central and southern Mexico from Aguascalientes to Chiapas. Complex earthquake, with at

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										least two events occurring about 4 seconds apart.
JUN	21	17 43 04.5	18.324 N	101.539 W	69	D	6.0	5.8	1.1	352 GUERRERO, MEXICO. Mw 6.2 (GS), 6.3 (HRV). MD 5.8 (UNM). Mo=2.6*10**18 Nm (GS). Mo=2.8*10**18 Nm (HRV). More than than 1,300 homes damaged including more than 600 at Coahuayutla, Guerrero. One church damaged at Cuitzeo, Michoacan. Minor damage in Morelos. Felt at Mexico City and in the states of Colima, Jalisco, Mexico, Oaxaca, Puebla, San Luis Potosi and Veracruz.
JUL	03	01 43 54.0&	47.076 N	123.463 W	41		5.4	5.5		380 WASHINGTON. . Mw 5.9 (GS), 5.9 (HRV). Mo=8.5*10**17 Nm (GS). Mo=7.9*10**17 Nm (HRV). Mo=3.4*10**17 Nm (PPT). Seven people injured in the Aberdeen-Satsop area and one person injured at Olympia. Damage (VII) at Aberdeen and Montesano. Slight damage (VI) at Brady, Central Park, Cosmopolis, Elma, Hoquiam, McCleary, Ocean Shores and Shelton. Felt (V) at many locations including Olympia, Seattle and Tacoma. Felt throughout western Washington and as far south as Portland and Tillamook, Oregon. Felt north as far as Nanaimo, Sidney, Vancouver and Victoria, British Columbia.
JUL	11	14 14 16.5	15.782 N	88.330 W	10	G	6.0	6.6	1.0	434 HONDURAS. Mw 6.7 (GS), 6.7 (HRV). Me 6.3 (GS). Ms 6.7 (BRK). Es=7.1*10**13 Nm (GS). Mo=1.4*10**19 Nm (GS). Mo=1.2*10**19 Nm (HRV). One person killed and another person died from a heart attack; at least 40 people injured in the Izabal-Puerto Barrios area, Guatemala. Seven houses destroyed, forty-one houses sustained considerable damage; three bridges damaged and damage to highways in the Izabal-Puerto Barrios area, Guatemala. Damage to buildings at a U.S. military base at Puerto Barrios, Guatemala. Minor damage in western Honduras. Felt throughout most of Honduras and in eastern Guatemala. Felt in Belize, El Salvador and at Villahermosa, Mexico.
JUL	22	10 42 11.7	21.544 N	91.895 E	10	G	5.2	4.2	0.8	154 BAY OF BENGAL. Six people killed, over 200 injured and about 700 homes damaged or destroyed on Maheshkhali Island, Bangladesh. Some damage at Cox's Bazaar. Felt at Chittagong and on Sandwip Island, Bangladesh.
AUG	01	08 39 04.9	30.367 S	177.832 W	10	G	5.7	6.4	0.8	275 KERMADEC ISLANDS, NEW ZEALAND. Mw 6.2 (GS), 6.6 (HRV). Me 6.0 (GS). Es=2.6*10**13 Nm (GS). Mo=2.4*10**18 Nm (GS). Mo=7.5*10**18 Nm (HRV). Mo=8.0*10**18 Nm (PPT).
AUG	10	19 33 59.8	36.245 N	54.645 E	33	N	4.5	4.3	1.1	58 NORTHERN IRAN. One person killed, one person injured and several houses damaged at Momenabad.
AUG	11	04 27 55.3	34.791 N	32.939 E	33	N	5.1	5.4	1.2	234 CYPRUS REGION. At least 15 people injured, 32 buildings damaged and landslides in the Limassol area. At least 50 buildings damaged in other parts of Cyprus. Felt at Paphos and Nicosia. Also felt in Egypt, Lebanon and Syria.
AUG	14	00 16 52.2	5.885 S	104.711 E	101	D	6.0	5.7	1.0	380 SOUTHERN SUMATERA, INDONESIA. Mw 6.5 (GS), 6.4 (HRV). Mo=5.5*10**18 Nm (GS). Mo=4.8*10**18 Nm (HRV). Felt (III) at Bengkulu and Kotabumi. Also felt (II) at Banten and Jakarta, Java.
AUG	17	00 01 39.1	40.748 N	29.864 E	17	G	6.3	7.8	1.3	381 TURKEY. Mw 7.4 (GS), 7.5 (HRV), 7.6 (CSEM). Me 7.7 (GS). Es=8.4*10**15 (GS). Mo=1.4*10**20 Nm (GS). Mo=2.1*10**20 Nm (HRV). Mo=2.4*10**20 Nm (CSEM). At least 17,118 people killed, 50,000 injured, thousands missing, about 600,000 people homeless and extensive damage in Istanbul, Kocaeli and Sakarya Provinces. Felt as far east as Ankara. Damage costs estimated at 3 to 6.5 billion U.S. dollars. Earthquake consisted of 120 km of right-lateral, strike-slip motion on the nearly vertical North Anatolian fault, between Karamursel and Golyaka. Rupture from west to east, in two rupture events. Duration of strong shaking 37 seconds; maximum fault displacement 5 meters; maximum acceleration 0.3-0.4g.
AUG	20	10 02 21.1&	9.044 N	84.159 W	20	G	6.1	6.9		542 COSTA RICA. . Mw 6.8 (GS), 7.0 (HRV). Me 6.5 (GS). ML 6.1 (CASC). Es=1.4*10**14 Nm (GS). Mo=1.8*10**19 Nm

										(GS). Mo=3.0*10**19 Nm (HRV). Mo=2.6*10**19 Nm (PPT). Some damage in western Panama. Felt in southern Nicaragua, western Panama and throughout Costa Rica. A small event is followed about two seconds later by a larger event.
AUG	22	12 40 45.9	16.117 S	168.039 E	33 N	6.3	6.2	1.1	272	VANUATU ISLANDS. Mw 6.5 (GS). 6.5 (HRV). Mo=6.5*10**18 Nm (GS). Mo=7.2*10**18 Nm (HRV). Felt strongly on Ambrym Island. Landslides and rockfalls on Ambrym Island.
AUG	31	08 10 49.5	40.711 N	29.949 E	10 G	5.2	4.9	1.0	327	TURKEY. MD 5.2 (ISK). One person killed. 166 injured and additional damage in the Izmit area. Also felt at Istanbul.
SEP	07	11 56 49.3	38.119 N	23.605 E	10 G	5.6	5.8	1.1	416	GREECE. Mw 5.9 (GS). 6.0 (HRV). ML 5.4 (THE). Mo=7.8*10**17 Nm (GS). Mo=1.1*10**18 Nm (HRV). One hundred forty-three people killed. 1,600 injured. 50,000 homeless and at least 53,000 buildings damaged or destroyed in the Athens area. Preliminary estimate of damage at 655 million U.S. dollars. Felt in much of central Greece and as far as Izmir, Turkey.
SEP	13	11 55 28.1	40.709 N	30.045 E	13 G	5.8	5.8	0.9	420	TURKEY. Mw 5.9 (GS). 5.8 (HRV). Me 5.7 (GS). Es=9.1*10**12 Nm (GS). Mo=7.9*10**17 Nm (GS). Mo=5.9*10**17 Nm (HRV). Six people killed, one died of a heart attack. 422 injured and additional damage in the Adapazari-Goluck-Kocaeli area. Felt in much of northwestern Turkey.
SEP	20	17 47 18.4	23.772 N	120.982 E	33 N	6.5	7.7	1.1	367	TAIWAN. Mw 7.6 (GS). 7.7 (HRV). Me 7.2 (GS). Es=1.2*10**15 Nm (GS). Mo=2.4*10**20 Nm (GS). Mo=4.1*10**20 Nm (HRV). Mo=5.2*10**20 Nm (PPT). At least 2,400 people killed and over 8,700 injured. About 82,000 housing units damaged and 600,000 people left homeless. Damage estimated at 14 billion U.S. dollars. Most affected areas were Nan-tou and Tai-chung Counties. Surface faulting occurred along 75 km of the Chelongpu Fault. Landslides blocked a river in Yunlin County. Felt strongly throughout Taiwan and in Fujian, Guangdong, Hong Kong and Zhejiang Provinces. Also felt (II JMA) on Iriomote-shima and Yonaguni; (I JMA) on Ishigaki-shima and Miyako-shima, Ryukyu Islands. Complex earthquake, with at least one larger event occurring about 12 seconds after the onset.
SEP	20	21 46 42.8	23.390 N	120.964 E	33 N	5.8	6.5	1.4	201	TAIWAN
SEP	25	23 52 48.6	23.738 N	121.158 E	17 G	6.2	6.4	0.9	405	TAIWAN. Mw 6.4 (GS). 6.5 (HRV). Me 6.2 (GS). Es=3.9*10**13 Nm (GS). Mo=4.7*10**18 Nm (GS). Mo=5.7*10**18 Nm (HRV). Additional casualties, damage and landslides in the epicentral area. Felt (V JMA) at Chai-i; (IV JMA) at Hua-lien; (III JMA) at I-lan and Tai-tung; (II JMA) at Kao-hsiung and Taipei. Felt in much of Taiwan. Felt (IV JMA) on Peng-hu Tao; (I JMA) on Iriomote-shima and Yonaguni, Ryukyu Islands. Also felt (IV JMA) in Hong Kong.
SEP	29	00 13 05.5	40.739 N	29.346 E	10 G	4.9	4.5	1.2	253	TURKEY. One person killed at Istanbul.
SEP	30	16 31 15.6	16.059 N	96.931 W	61	6.5	7.5	0.9	631	OAXACA, MEXICO. Mw 7.4 (GS). 7.5 (HRV). Me 7.2 (GS). Es=1.2*10**15 Nm (GS). Mo=1.4*10**20 Nm (GS). Mo=2.0*10**20 Nm (HRV). Mo=2.4*10**20 Nm (PPT). Thirty-one people killed, 160 injured, hundreds of buildings damaged, utilities disrupted and roads blocked by landslides in the state of Oaxaca. One person killed and minor damage to some buildings at Mexico City. One person killed at Cordoba, Veracruz. Felt from the state of San Luis Potosi to Guatemala.
OCT	05	00 53 28.9	36.730 N	28.240 E	33 N	4.9	4.6	1.2	232	DODECANESE ISLANDS. Mw 5.6 (CSEM). ML 4.9 (THE). Mo=2.9*10**17 Nm (CSEM). At least 103 people injured in the Marmaris area, Turkey. Also felt on Kos and Rhodes, Greece.
OCT	13	01 33 40.1	54.657 N	161.189 W	30 G	6.0	6.2	1.0	446	ALASKA PENINSULA. Mw 6.3 (GS). 6.5 (HRV). Me 5.8 (GS). ML 6.0 (PMR). Es=1.1*10**13 Nm (GS). Mo=2.9*10**18 Nm (GS). Mo=5.5*10**18 Nm (HRV). Mo=5.5*10**18 Nm (PPT). Felt (IV) at Chignik Lagoon, Cold Bay, Ivanof Bay, Perryville, and Sand Point. Two events about 4 seconds apart.

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OCT 16	09 46 44.1&	34.594 N	116.271 W	0	6.3	7.4		527	SOUTHERN CALIFORNIA. . Mw 7.1 (GS). 7.1 (HRV). 7.0 (BRK). Me 7.6 (GS). Es=5.6*10**15 Nm (GS). Mo=5.4*10**19 Nm (GS). Mo=5.9*10**19 Nm (HRV). Mo=4.0*10**19 Nm (BRK). Four people slightly injured when an Amtrak train derailed near Ludlow. Damage (VII) at Landers, Ludlow, Twentynine Palms and Twentynine Palms Marine Corps Base. Slight damage (VI) at Amboy, Apple Valley, Baker, Barstow, Big Bear Lake, Cima, Crest Park, Desert Center, Essex, Fawnskin, Fort Irwin, Hemet, Highland, Hinkley, Joshua Tree, Lucerne Valley, Newberry Springs, Olancha, Palm Springs, Phelan, Ridgecrest, Tecopa, Thousand Palms and Victorville. Also slight damage (VI) at Laughlin, Nevada. Felt (V) at many localities in southern California, southern Nevada and western Arizona. Surface faulting observed along a 40-kilometer segment of the Lavic Lake fault with as much as 2.8-4.7 meters right-lateral displacement.
OCT 22	02 18 58.5	23.445 N	120.506 E	33 N	5.7	5.6	1.0	299	TAIWAN. Mw 5.9 (GS). 5.8 (HRV). Mo=7.0*10**17 Nm (GS). Mo=6.6*10**17 Nm (HRV). One person killed, 254 people injured and 15 buildings collapsed in the Chia-i area. Felt throughout Taiwan. Also felt (IV JMA) at Hong Kong.
OCT 31	13 27 42.4?	13.64 S	74.43 W	62 D	4.4		1.3	21	CENTRAL PERU. Thirty people injured, 210 houses destroyed and 1,100 houses damaged in the Chuschi area. Felt (II) at Cangallo and Huancapi.
OCT 31	15 09 39.8	29.413 N	51.807 E	33 N	5.0	4.9	1.3	196	SOUTHERN IRAN. Thirty-eight people injured, some buildings damaged and power outages in the Kazerum area.
NOV 01	13 25 16.5	39.899 N	113.983 E	10 G	5.1	5.3	1.2	120	NORTHEASTERN CHINA. Four people injured and 6,000 houses damaged in Shanxi Province. Some damage in Hebei Province. Felt at Hohhot and Tianjin.
NOV 07	16 54 41.7	40.693 N	30.725 E	10 G	4.9	4.2	1.1	186	TURKEY. One person died from a heart attack at Hendek. Felt in the Adapazari-Istanbul area.
NOV 08	16 45 43.0	36.522 N	71.240 E	228 D	6.2		1.0	436	AFGHANISTAN-TAJIKISTAN BORD REG. Mw 6.5 (GS). 6.5 (HRV). Mo=7.0*10**18 Nm (GS). Mo=6.4*10**18 Nm (HRV). One person injured at Kabul; felt throughout eastern Afghanistan. Felt in much of Pakistan from North West Frontier Province to parts of Sindh Province. Felt at Srinigar, Jammu and Kashmir. Also felt in many parts of northern India as far south as Delhi.
NOV 11	14 41 25.6&	40.744 N	30.266 E	22	5.5	5.5		472	TURKEY. . Mw 5.7 (GS). 5.7 (HRV). 5.7 (CSEM). MD 5.7 (ISK). ML 5.2 (THE). Mo=3.5*10**17 Nm (GS). Mo=3.6*10**17 Nm (HRV). Mo=3.8*10**17 Nm (CSEM). One person killed, one died of a heart attack and 156 injured at Adapazari. Thirteen people injured at Koceali and two injured at Golcuk. Felt at Istanbul and Sapanca.
NOV 12	16 57 19.5	40.758 N	31.161 E	10 G	6.3	7.5	1.1	484	TURKEY. Mw 7.1 (GS). 7.2 (HRV). 7.0 (CSEM). Me 7.2 (GS). ML 6.6 (THE). Es=1.3*10**15 Nm (GS). Mo=4.5*10**19 Nm (GS). Mo=6.5*10**19 Nm (HRV). Mo=4.1*10**19 Nm (CSEM). At least 834 people killed and 4,566 injured in the Bolu-Duzce-Kaynasli area; 4 killed and 168 injured at Adapazari; 3 killed and 189 injured at Zonguldak; 1 killed and 25 injured at Yalova; 1 killed at Eskisehir. Extensive damage occurred in the Bolu-Duzce-Kaynasli area. Landslides in the Bolu Pass blocked the Ankara-Istanbul highway. Felt as far as Ankara, Istanbul and Izmir. Also felt (III) at Chisinau, Moldova and (III) at Sevastopol and Simferopol, Ukraine. Complex event.
NOV 15	05 42 43.2	1.339 S	88.976 E	10 G	6.3	6.9	1.0	457	SOUTH INDIAN OCEAN. Mw 6.8 (GS). 7.0 (HRV). Me 7.4 (GS). Es=3.2*10**15 Nm (GS). Mo=1.6*10**19 Nm (GS). Mo=3.3*10**19 Nm (HRV). Felt in the Colombo area, Sri Lanka.
NOV 17	03 27 42.0	5.978 S	148.820 E	48	5.9	7.0	0.9	336	NEW BRITAIN REGION, P.N.G. Mw 7.0 (GS). 6.9 (HRV). Mo=3.0*10**19 Nm (GS). Mo=2.9*10**19 Nm (HRV). Mo=2.6*10**19 Nm (PPT). Felt at Kimbe and in western New Britain.

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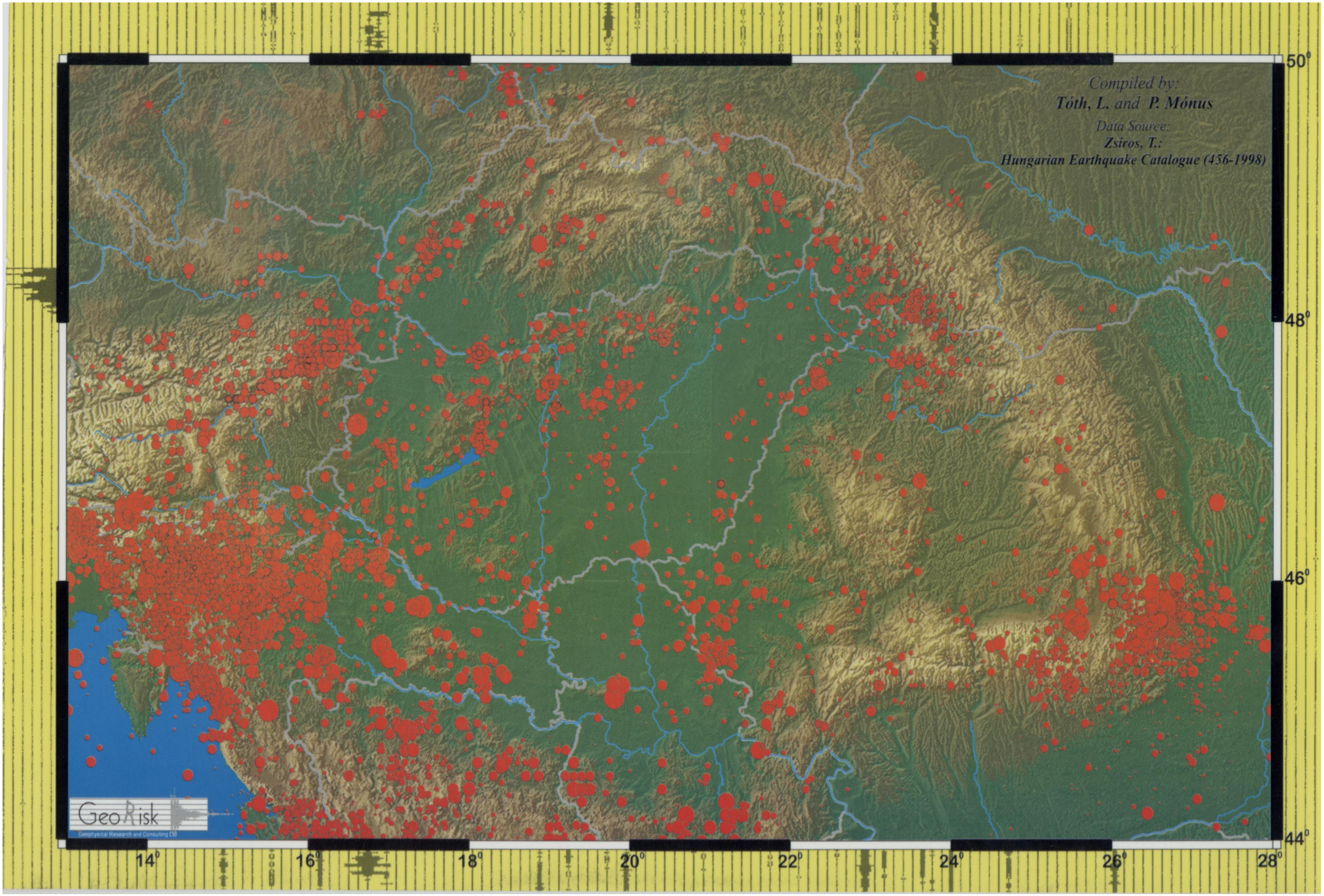
NOV 19	13 56 46.6	6.375 S	148.808 E	33 N	6.0	7.0	1.1	79	NEW BRITAIN REGION, P.N.G. Mw 6.9 (GS), 7.0 (HRV). Mo=2.4*10**19 Nm (GS). Mo=3.9*10**19 Nm (HRV).
NOV 24	16 40 21.2*	24.407 N	102.644 E	33 N	4.7		1.2	10	YUNNAN, CHINA. One person killed, five people injured and at least 90 buildings destroyed in the Chengjiang area.
NOV 26	13 21 15.4	16.434 S	168.227 E	33 N	6.5	7.3	0.9	119	VANUATU ISLANDS. Mw 7.3 (GS), 7.5 (HRV). Mo=9.3*10**19 Nm (GS). Mo=2.0*10**20 Nm (HRV). Mo=4.5*10**20 Nm (PPT). At least five people killed and 100 injured by collapsed buildings and landslides on Pentecost Island. At least three people killed and two others missing off the south coast of Pentecost Island by a local tsunami, which was also recorded at Suva, Fiji. Felt strongly on Ambrym and Epi. Felt in much of Vanuatu.
NOV 29	03 46 30.2	1.291 S	89.059 E	10 G	5.9	6.5	1.2	196	SOUTH INDIAN OCEAN. Mw 6.4 (GS), 6.4 (HRV). Mo=3.9*10**18 Nm (GS). Mo=4.2*10**18 Nm (HRV). Felt on Sri Lanka.
NOV 30	04 01 53.1	18.925 S	69.207 W	128 D	6.2		0.9	282	NORTHERN CHILE. Mw 6.5 (GS), 6.6 (HRV). Mo=7.2*10**18 Nm (GS). Mo=7.5*10**18 Nm (HRV). Felt (V) at Arica, Camarones, Putre, Tarapaca and Ticnamar; (IV) at Iquique and (III) at Antofagasta, Chile. Also felt (V) at Tanca and (III) at Arequipa and Ilo, Peru.
DEC 03	17 06 54.5	40.341 N	42.307 E	14	5.4	5.5	1.1	124	TURKEY. Mw 5.6 (GS), 5.8 (HRV). Mo=3.2*10**17 Nm (GS). Mo=4.8*10**17 Nm (HRV). One person killed at Goresken. Six people injured, several houses and roads damaged and one road closed due to landslides in Erzurum Province. Also felt at Batumi, Georgia.
DEC 06	23 12 30.0	57.455 N	154.566 W	33 N	6.5	6.7	1.0	138	KODIAK ISLAND REGION. Mw 7.0 (GS), 7.0 (HRV). Mo=3.4*10**19 Nm (GS). Mo=3.6*10**19 Nm (HRV). Pictures knocked from walls and power outages on Kodiak Island. Felt at Akhiok, Anchorage, Dillingham, Eagle River, Fairbanks, Kasilof, Nelson Lagoon, Nikiski, Old Harbor and Wasilla.
DEC 07	00 19 50.1	57.417 N	154.477 W	44	6.5	6.0	1.1	282	KODIAK ISLAND REGION. Mw 6.4 (HRV). ML 6.3 (PMR). Mo=5.2*10**18 Nm (HRV). Felt at Anchorage, Homer and Kodiak.
DEC 10	18 38 29.3	36.287 S	97.177 W	10 G	5.7	6.2	1.2	125	WEST CHILE RISE. Mw 6.5 (GS), 6.5 (HRV). Mo=7.0*10**18 Nm (GS). Mo=7.0*10**18 Nm (HRV).
DEC 11	18 03 36.5	15.776 N	119.767 E	33 N	6.5	7.1	1.0	213	LUZON, PHILIPPINE ISLANDS. Mw 7.1 (GS), 7.3 (HRV). Me 7.1 (GS). Es=1.1*10**15 Nm (GS). Mo=5.8*10**19 Nm (GS). Mo=9.6*10**19 Nm (HRV). Mo=1.3*10**20 Nm (PPT). One person killed by a collapsed wall at Masinloc. Four people died from heart attacks and 40 injured on Luzon. Damage to structures (VII RF) at Santa Cruz; (VI RF) at Iba, Manila and Masinloc. Felt (VI RF) at Clark Air Base and San Fernando; (V RF) at Dagupan, Pasig, Quezon and Taguig; (IV RF) at Baguio, Lucban, Malolos, Palayan, San Jose, Santo Domingo and Tagaytay; (III RF) at Santa; (II RF) at Guinyangan; (I RF) at Tuguegaro. Power outages in the Manila area.
DEC 21	14 14 57.0	6.816 S	105.650 E	56 D	6.1		1.0	106	SUNDA STRAIT. Mw 6.5 (GS), 6.6 (HRV). Mo=5.6*10**18 Nm (GS). Mo=9.2*10**18 Nm (HRV). At least five people killed, 220 injured and 2,800 houses damaged in western Java.
DEC 22	17 36 56.0	35.232 N	1.277 W	10 G	5.5	5.5	1.1	192	NORTHERN ALGERIA. At least 24 people killed, 175 injured and several buildings destroyed in the Ain Temouchent area. Felt at Arzew, Mascara, Oran and Tlemcen. Also felt at Oujda, Morocco.
DEC 29	13 29 19.5	10.909 S	165.394 E	33 N	5.7	6.8	0.8	107	SANTA CRUZ ISLANDS. Mw 6.8 (GS), 6.3 (HRV). Mo=1.8*10**19 Nm (GS). Mo=3.1*10**18 Nm (HRV). Mo=2.5*10**19 Nm (PPT).

Compiled by Waverly J. Person --- January 13, 2000
URL: http://neic.usgs.gov /neis/eqlists/sig_1999.html


Compiled by:
Tóth, L. and P. Mónus
Data Source:
Zsíros, T.:
Hungarian Earthquake Catalogue (456-1998)
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